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COUNTRY UPDATE FROM GEORGIA

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ABSTRACT

This paper reviews the present status and future utilization of Georgian thermal waters. Contemporary conditions in South Caucasus and in Georgia particularly, maintain intensive use of geothermal energy. Confirmed total reserves are 90,000 m^3/day as of 1998, which by its heat potential's equal to 500,000 tonnes of equivalent fuel (TEF) annually. Using a modern technology – an artificial geothermal circulation systems (GCS) – it is possible to save 2.5 million TEF annually. Tbilisi geothermal field is described as an example of a project with efficient resource utilization, which proves that geothermal energy is cheaper, and environmentally friendly in the given condition. Finally, it is possible to reduce the great amount of CO_2 released into the air by replacing traditional fuels with geothermal energy.

1. INTRODUCTION

Utilization of the geothermal energy has proved to be highly effective and economic, especially in contemporary conditions. These conditions are as follows:

In Azerbaijan the main source of energy is traditional fuel (oil), which is unsatisfactory due to technology (burning of oil) and environment pollution.

In Armenia the main station is fueled by nuclear material, which is very dangerous, because it is situated in a tectonically active zone.

In Georgia, which also has a big amount of hydropower (Table1), the main Enguri station is established in a politically unstable region. Tbilisi thermal electric power station runs on oil and gas, which is troublesome to import.

All these factors encourage development of intensive utilization of geothermal resources. Estimations have shown also that, in the majority of cases, geothermal heat is 5-6 times cheaper than other kinds of fuel and the period of recoupment of investments is shorter (Buachidze at al., 1980).

2. RESOURCES

The history of using thermal waters as a thermal power begin in 1951, when explorers for coal discovered water with temperature 80^0 C in a well drilled in the village of Tsaishi not far from the Zugdidi region and on the basis of which a middle-size greenhouse was built.

Currently, about 250 natural (springs) and artificial (wells) water manifestations with temperature 30^0 C – 108^0 C have been registered in Georgia. Their total discharge is about 160 000 m^3/day. But their potential is far greater. It has been established that the thermal water inferred resources are 350-400 million m^3 per annum. As of January 1998 the confirmed thermal water reserves were 90 000 m^3/day which, by its heat potential, is equal to 500 000 TEF annually.

Today the amount of confirmed reserves does not correspond to reality for, under the current conditions of exploitation, well pressure and discharge rates are dropping. There are cases when drilling caused considerable growth of the confirmed reserves (Zugdidi-Tsaishi, Kindgi, etc.). Apart from this, it is necessary to bear in mind, that in some regions of Western Georgia the situation at the fields has crucially changed due to hostilities. This has made it necessary for us to examine the current situation at the existing low-enthalpy fields and to re-assess their reserves (Table2)(Buachidze and Tsertsvadze, 1998). Applying a modern technology – GCS – it is possible to save 2.5 million TEF annually.

3. UTILIZATION

Using just part of this great amount of energy will help the present economic situation to improve.

An example of the important subject of the solution of energy problems is Tbilisi, capital of Georgia. One should note here that the thermal water field is situated within the city and its environs. Since 1975 it has yielded above 20 million m^3 of thermal water. At present the flow of the wells amounts to only 4000 m^3/ day. To assure efficient utilization it is necessary to deepen the water extraction (by means of submersible pumps) and creating GCS. Existing wells in Paleogene give us the possibility of installing thermal power (ITP) of 25 MW and an annual capacity almost 25000 MW hour. The heat prime cost (HPC) is $ 4-5 per MWh and granted capital outlays (GCO) are no more than $ 4.0 million; the self-repayment terms (SRT) are 1.5-2.0 years.

Another project plans to use the Upper Cretaceous aquifer, where the design depth reaches 4.5 km while the predicted temperature exeeds 150^0C. In order to create a GCS here it is necessary to drill new wells, the cost of which will reach $25-30 million. HPC will be not more than $8-10 per MWh and SRT equal 5-8 years. All this energy will be enough for one region with 100,000 families to satisfy the requirements of district heating and hot water supply (Buachidze, 1995). This project is ready for investment and international firms are sought.

After successful construction of this GCS it is possible to plan 15-20 such systems for Tbilisi and the adjoining territory with 7.0 million MWh annually.

Among the thermal potential available in Georgia, the Zugdidi – Tsaishi field is of special importance due to its extensive exploitation and availability of reinjection wells, the considerable amount of tapped resource, favorable conditions and numerous large consumers. The project for this field has the following technical–economical parameters : wells with depths of 1272 – 2820 m (Lower Cretaceous intensively fractured, karsted limestones and dolomites); fresh waters with temperatures 83 – 98^0 C; system's thermal capacity – 65 MWt; annual heat amount – 250,000 MWh;

heat cost –$ 3 – 7 per MWh; investments – $ 5.5 million; operational expenses –$ 880 thousand per year and recoupment period of investments – 3-7 years (Buachidze and Tsertsvadze, 1998).

4. SUMMARY

The contemporary state of geothermal activity in Georgia is shown in Tables 3, 4, 5 and 6.

In spite of the decline in activity today there are good prospects for the future. Existing projects prove that geothermal energy is cheap and environment–friendly in the given conditions. Confirmation of this is also the possibility of reducing the amount of CO_2 released into the air by about 1,200,000 tonnes annually by the replacement of traditional fuel with geothermal energy.

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Table 1. PRESENT AND PLANNED PRODUCTION OF ELECTRICTY

	Geothermal		Fossil Fuels		Hydro		Nuclear		Other Renewables (small hydrostations)		Total	
	Capacity MWe	Gross Prod GWh/yr	Capacity MWe	Gross Prod GWh/yr	Capacity MWe	Gross Prod GWh/yr	Capacity MWe	Gross Prod GWh/yr	Capacity MWe	Gross Prod GWh/yr	Capacity MWe	Gross Prod GWh/yr
In operation in January 2000	_	_	1718	1698	2473	6163	_	_	105	287		8088
Under construction in January 2000				2300		_				510		2810
Funds committed, but not yet under construction in January 2000				6000		1900				700		8600
Total projected use by 2005	0.5	5.0		10000		8000				1500		25000

TABLE 3. SUMMARY TABLE OF GEOTHERMAL DIRECT HEAT USES AS OF 31 DECEMBER 1999

Use	Installed Capacity[1)] (MWt)	Annual Energy Use[2)] (TJ/yr)	Capacity Factor[3)]
Space Heating	205.1	5941.6	0.92
Air Conditioning (Cooling)			
Greenhouse Heating	291.4	8552.2	0.93
Fish and Animal Farming	295.4	8699.2	0.93
Agricultural Drying	276.2	7946.7	0.91
Industrial Process Heat	87.7	2564.6	0.93
Snow Melting			
Bathing and Swimming	342.3	9985.7	0.92

TABLE 2. UTILIZATION OF GEOTHERMAL ENERGY FOR DIRECT HEAT AS OF 31 DECEMBER 1999

Locality	Type[1)]	Maximum Utilization					Capacity[3] (MWt)	Annual Utilization		
		Flow Rate (kg/s)	Temperature (^{0}C)		Enthalpy (kJ/kg)			Ave. Flow (kg/s)	Energy[4] (TJ/yr)	Capacity Factor[5)]
			Inlet	Outlet	Inlet	Outlet				
Dranda	G,B	17.4	93	25			4.9	15	134.5	0.87
Kindgi	G,A,F,H,B	308.6	108	25			107.1	280	3065.3	0.91
Mokvi	G, A, F, B	155.4	105	25			52.0	160	1688.3	1.0
Okhurei	G, A, B	40.6	104	25			13.4	35	364.7	0.86
Rechkhi	G, A, F, B	12.8	77	25			2.8	10	68.9	0.77
Zugdidi-Tsaishi	G,A,F,H,B,I	285.4	98	25			87.2	265	2551.6	0.92
Kvaloni	F, B	49.9	98	25			15.2	45	433.3	0.90
Khobi	G, A, B	5.1	82	25			1.2	4	30.1	0.78
Bia	A, F, B	30.2	65	25			5.1	28	147.7	0.93
Zana	A, B	4.6	101	25			1.46	3	30.1	0.65
Menji	F, B	67.3	65	25			11.3	62	327.1	0.92
Nokalakevi	G, B	8.1	82	25			1.9	7	52.6	0.87
Tskaltubo	B	232	35	25			9.7	215	283.6	0.93
Samtredia	G, B	34.8	61	25			5.2	30	142.4	0.86
Vani region	F, B	25.5	60	25			3.7	20	92.3	0.79
Vani	G, B	32.5	60	25			4.7	28	129.3	0.87
Abastumani	B	11.6	48	25			1.1	9	27.3	0.79
Vardzia	I, B	3.5	58	25			0.5	3	13	0.83
Tsromi	B	8.1	55	25			1.0	6	23.7	0.75
Tbilisi I	G, F, H, B	44.1	70	10			11.0	41	324.5	0.93
Heretiskari	B	38.3	37	25			1.9	35	55.4	0.92
SUBTOTAL		1415.8					342.3	1301	9986,1	
small manifestation							7.7			
TOTAL		1415.8					350		9985.7	

TABLE 4. WELLS DRILLED FOR ELECTRICAL, DIRECT AND COMBINED USE OF GEOTHERMAL RESOURCES FROM JANUARY 1, 1995 TO DECEMBER 31, 1999

Purpose	Wellhead Temperature	Number of Wells Drilled				Total Depth (km)
		Electric Power	Direct Use	Combined	Other (for oil)	
Exploration	(all)			_	2	4.1
Production	>150^{0}C			_		
	150-100^{0}C			_		
	< 100^{0}C		1	_		2.5
Injection	(all)			_		
Total			1		2	6.6

TABLE 5. ALLOCATION OF PROFESSIONAL PERSONNEL TO GEOTHERMAL ACTIVITIES (Restricted to personnel with a University degrees)

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

Year	Professional Person – Years of Effort					
	(1)	(2)	(3)	(4)	(5)	(6)
1995	30	5	8	_	2	3
1996	28	5	6	_	1	5
1997	26	5	7	_	_	5
1998	25	5	5	_	1	7
1999	25	5	5	_	_	10
Total	134	25	31		4	30

TABLE 6. TOTAL INVESTMENTS IN GEOTHERMAL IN (1999) US$

Period	Research & Development Incl. Surface Explor. &Exploration Drilling Million US$	Field Development Including Production Drilling & Surface Equipment Million US$	Utilization		Funding Type	
			Direct Million US$	Electrical Million US$	Private %	Public %
1985-1989	3	20	12	_	_	100
1990-1994	0.2	0.1	0.3	_	50	50
1995-1999	0.5	0.2	0.3	_	100	_