DEVELOPMENT AND APPLICATION OF GEOTHERMAL MINEWATER ENERGY FROM THE ABANDONED COAL MINES IN THE SPRINGHILL COAL FIELDS, SPRINGHILL, NOVA SCOTIA, CANADA

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ABSTRACT:

Test drilling and geochemical testing into the abandoned coal mines below the town of Springhill N.S. were conducted during 1987, 1988 and 1990 to investigate claims of anomalously warm mine water temperatures.

A program of test drilling and mine water testing was carried out through the combined efforts of Energy Mines and Resources Canada, the Nova Scotia Department of Natural Resources and the Town of Springhill N.S. This work resulted in the indentification and location of the mine water resource, conceptual engineering towards development and, finally, design and application of the geothermal minewater project.

Five geothermal minewater demonstration sites are presently in operation within the Town of Springhill to date and from operational readings have confirmed that the utilization of warm mine water through the application of water source heat pumps can result in energy savings near 60% for the user.

Geothermal minewater technology is site specific in energy source since flooded abandoned mines are required. Coal mines, Gold mines, Copper mines etc. are all capable of being developed for geothermal use. Elevated mine water temperatures account for only a portion of the energy saving ability of this resource with greater emphasis being placed on water quanity to accomplish higher BTU's and COP's. Throughout Nova Scotia and areas across Canada geothermal minewater projects are presently being explored for various application. What once was considered the waste cavity product from mining now offers a new opportunity for once prosperous mining communities.

MISE EN VALEUR ET APPLICATION DE L'ÉNERGIE GÉOTHERMIQUE DES EAUX DES MINES DE CHARBON ABANDONNÉES DANS LES GISEMENTS DE CHARBON DE SPRINGHILL SPRINGHILL, NOUVELLE-ÉCOSSE, CANADA

RÉSUMÉ

Des forages expérimentaux et des essais géochimiques ont été exécutés en 1987, 1988 et 1990 dans les mines de charbon abandonnées sous la ville de Springhill (N.-É.) dans le but d'étudier des affirmations concernant la présence d'eaux de mine anormalement chaudes.

Un programme de forages expérimentaux et d'analyse d'eaux de mine a été mené à bien en collaboration par Énergie, Mines et Ressources Canada, le Department of Natural Resources de la Nouvelle-Écosse et la ville de Springhill (N.-É.). Ces travaux ont permis l'identification et la localisation de la ressource que constituent les eaux de mine, une étude de définition de concept et enfin la conception et l'application du projet d'exploitation géothermique des eaux de mine.

Cinq emplacements de démonstration de l'exploitation géothermique des eaux de mine sont actuellement utilisés par la ville de Springhill et les résultats opérationnels obtenus jusqu'à maintenant ont confirmé que l'utilisation des eaux de mine chaudes dans des pompes à chaleur à l'eau peut permettre des économies d'énergie de l'ordre de 60 % pour les utilisateurs.

La technologie de l'exploitation géothermique des eaux de mine est d'application spécifique puisqu'elle exige la présence de mines abandonnées. Les mines de charbon, d'or, de cuivre, etc., pourraient toutes êtres mises en valeur à des fins géothermiques. Les températures élevées des eaux de mine ne représentent qu'une partie des possibilités d'économies d'énergie qu'offre cette ressource, une plus grande emphase étant accordée aux quantités d'eau permettant d'obtenir davantage de BTU et de meilleurs COP. D'un bout à l'autre de la Nouvelle-Écosse et du Canada, des projets d'exploitation géothermique des eaux de mines à diverses fins sont actuellement étudiés. Des cavités autrefois considérées comme les restes inutiles de l'exploitation minière constituent maintenant de nouvelles occasions d'affaires pour des communautés minières jadis prospères.

1. BACKGROUND:

Interest in the utilization of geothermal energy has been ongoing since 1984 when Ralph Ross, a resident of the Town, presented a brief to Town Council on the possible uses of warm mine water for space heating and community job creation.

The Town Council approved funding to pursue the feasibility of the idea and appointed a geothermal committee comprising of three members. One member representing the Towns interest in respect of the Towns financial commitment, one member from business/industry and one citizen member with engineering skills. This committee served until 1991 and seen the geothermal project from an idea through to the actual application stage. A Geothermal Committee appointed in 1992 worked with a term position employee and publicized geothermal throughout Canada, Europe and Japan. Promotional activities are presently being concentrated on by a new committee and although the application of geothermal minewater is now a proven form of alternative energy, the measurement of success for the Town of Springhill can only be measured with the number of jobs created through the attraction of new industry to the area of by the salvation of existing jobs by upgrading existing buildings resulting in lowered operating costs.

The Town of Springhill, N.S. has a population of approximately 5000 and is located in Cumberland County in the northwestern part of Nova Scotia. Springhill is famed for having the deepest coal mine in North America with a depth of 1323 metres. Coal mining became the primary industry for the town in 1849 and continued until a series of mining disasters forced the closure of the mines in 1958. In total, more than 400 men and boys were killed in the tunnels beneath the Town and hundreds of others were injured in search of the precious ore. Today the mine tunnels are flooded to near surface and the work done by the early coal miners provides a valuable resource for the community.

2. THE RESOURCE

Five water filled, worked out seams remain from the earlier days of mining and include the number 1, 2, 3, 6 and 7 coal seams. The number 2 seam is the deepest seam or coal mine and dips into the earth at a 32 degree angle for a distance of four kilometres.

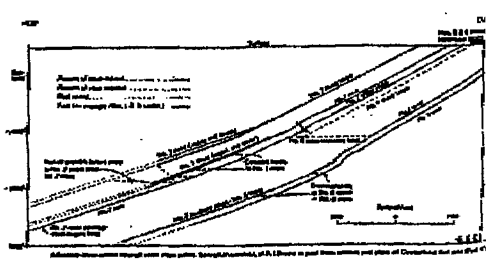

Figure 1

Working tunnels or "levels" are driven off the main haulage at a 90 degree angle and at approximately every 100 metres all the way to the bottom of the mine. The average distance of each of the working tunnels is 2.0 kilometres.

Interconnection between the number 1, 2 and number 3 seams occurs at various depths by means of man made tunnels and travelling routes which now provides a natural circulation passage within the flooded tunnels. Interconnection between the number 6 and 7 seams also occurs at various depths within the mine.

Because of the interconnecting layout of the coal mines, grouping of the number 1, 2, and 3 seams (called the deep group) and the number 6 and 7 seams (called the shallow group) provide for two separate geothermal aquifers for the geothermal system. The term deep and shallow group relates to the depth of active mining in the seam.

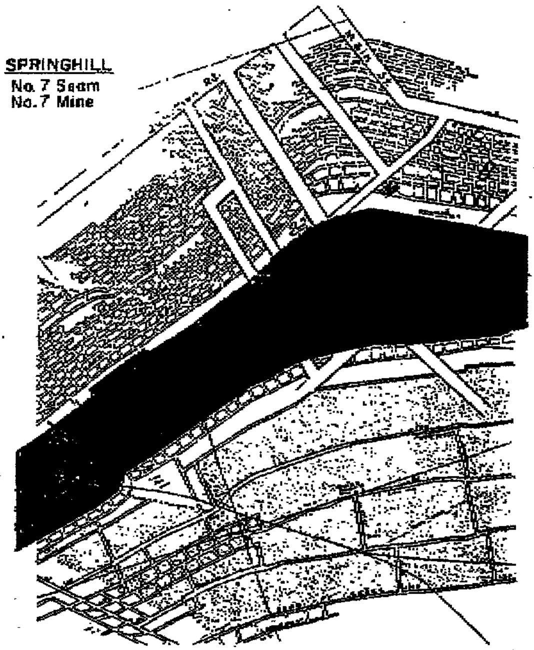

Figure 2

Tunnel sizes average a width of twelve feet and a height of five to eight feet. Small connecting passages between adjoining tunnels were constructed for breathing air and ventilation routes and again assist in the circulation of the warm mine water.

Subsidence at depth is considered probable in view of deterioration of support timbers over the years. This "caving" or collapsing of the tunnels results in voiding of the earth directly above which provides yet another route for the circulating mine water.

Entry into the number 3 seam was gained in 1984 at a time when a near surface tunnel collapsed and allowed for entry into the old workings. Observations, water sampling and water temperature measurements were taken at which time a temperature of 21.0 degrees C. were observed. Further noted was the rapid circulation and marked clarity of the mine water. The author noted that a distance greater than 100 metres could be viewed through the mine water which rose up from the main haulage and travelled latterly into the adjoining tunnels. Cooling off the mine water was predicted to travel along the tunnel until a slope or route to the depths was reached at which time the cooler mine water would sink into the depths to be reheated and at which time the natural circulation of warm water rising and cool water lowering would be repeated.

Mine water samples taken were later sent out and analyzed to identify impurities and will be referred to later.

The five mine seams are sandwiched on top of one another at a spacing of approximately 35.0 metres. Their interconnection and water passages resemble and operate as a large radiation system that provides a near exhaustible supply of warm geothermal minewater.

The geothermal mining boundaries extend below one quarter of the Town of Springhill with the main haulage being located within the Towns Industrial Park.

3. MINE WATER HEAT PUMP CONCEPT

An engineering and cost feasibility study (Booth 1986) commissioned by the Geothermal Committee indicated that a mine water geothermal/heat pump concept was technically sound, and that such a development would improve the economics of existing industries in the area, attract new industries and result in increased employment opportunity.

Numerous sites and potential users were identified in the study with cost savings being indicated. Energy savings of 60 to 75 percent were given for specific users of which the ROPAK CAN-AM plastic manufacturing plant was included. This facility was later to become Canada's first mine water geothermally heated demonstration site.

Conceptual design for the geothermal heat pump system included the requirement for the installation of a supply and return well which would be drilled into the mine workings from surface. Insallation of a deep well pump in a supply well would providethe heat pumps system with the water energy source. Return route for the mine water would be through the second well.

Supply and return well targets would be dependant upon mine water temperatures and water quantities within the five mine seams with further consideration given in regards to location of well and location of potential user of the energy reserve.

The mine water coupled heat pump concept was designed for the extraction of warm mine water stored in the abandoned coal mines and passing it directly through conventional ground water heat pump systems to increase the temperature of the outlet water or space heating air for heating requirements. The utilization of expensive heat exchangers would be considered in view of possible metal corrosives should final chemical testing of the mine water indicate the presence of this problem.

The efficiency of heat pumps at normal ground water temperatures is well documented. These systems are widely utilized throughout the United States, but to date little application of heat pumps has occured in Canada in part due to colder climatic conditions and lower averaged ground water temperatures (9.5 C. JWA, p.n. 4215, Sept 1987).

In Springhill, N.S., the presence of seemingly unlimited volumes of anomalously warm mine water near the surface and near populated areas would result in high COP's in any heat pump application. In consideration of the estimated size of the mine water resource, this high COP factor would apply to both small and large systems including district heating schemes of limited sizes.

Further development of the geothermal project was dependant upon actual exploration of the mine workings since no drilling had been completed and only very limited access to mine waters had been accomplished. In 1987 the first of three geothermal wells were drilled into the number 2 mine cavity.

4. GEOTHERMAL WELL DEVELOPMENT

Three initial geothermal wells (GTW's) totalling 230 metres of drilling were constructed by air rotary drilling at sites located near the Industrial Park and the Town of Springhill Community Arena. All test wells encountered the number 2 mine seam at depths ranging from 40.2 m at the Industrial Park to 84.0 m below ground at the Community Arena.

Geological logging placed empahasis on the lithology and hydrology of the strata overlying the mine workings. Estimates of aquifer yield were determined throughout the drilling by observation of air lift well discharge.
At the completion of drilling each test well was logged thermally and profiled over the next several days to establish pre pumping geothermal gradients.

Geothermal test well 3 (GTW 3) encountered the open number 2 haulage way at a depth of 40.4 metres

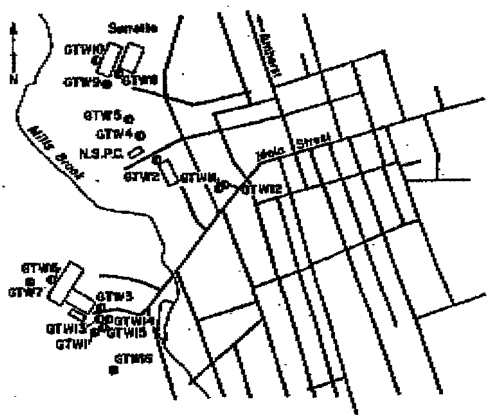

Figure 3

and was subsequently reamed to 203 mm diameter to accommodate a 25 hp electric submersible pump which was installed in the well to a depth of 42.0 metres, approximately 1 metre above the bottom of the open mine workings.

Well casing for well number 3 was driven 0.2 metres into bedrock.

A seven day pump test was initiated on well number 3 on August 7, 1987 at a continuous discharge rate of 16.9 L/s. This rate was selected to simulate a major heat pump operation and to remove enough mine water to assess chemical changes induced by large scale pumping.

The well discharge was directed via a 100mm hose to a field about 75 metres north of the well where the majority of the discharge water infiltrated directly into the overlying mine seam number 1. The discharge rate was monitored throughout the test with flow meters.

Water sample collection and monitoring of sensitive parameters such as pH, dissolved oxygen, conductance and temperature was done in a flow through cell apparatus installed on the discharge line to prevent mine water from contacting the atmosphere.

Prior to testing, groundwater samples were collected from the overlying aquifer, from the coal zones and mine water from open workings (GTW 3) to characterize the geochemical regime prior to disruption by pump testing. At this point key indicator parameters for monitoring during the pump testing were selected.

During the pump test, water samples were gathered at 6 hour intervals and analyzed for key mine water indicator parameters (sulphate, iron, amonia) to assess chemical changes during pumping. Throughout the 7 day test, hydraulic head was monitored in the pumping well (GTW 3) and the two remaining wells (GTW 1 & 2) which were now being used as observation wells.

At the end of the test a total of 10,000 cubic metres of mine water was removed from the number 2 mine through GTW 3 representing the equivalent of 0.65 km of mine shaft approximately 4 m square.

To date a total of 16 GTW wells have been drilled into the coal seams of Springhill N.S. as listed below:

TABLE 1:

WELL LOCATION	GTW #	SEAM	Remarks
ROPAK CAN AM	GTW 1	-	TARGET MISSED
COMMUNITY ARENA	GTW 2	2	TARGET MISSED
INDUSTRIAL PARK	GTW 3	2	SUPPLY, DIST HEAT
NSLP PAVED YARD	GTW 4	2, 1	-
NSLP STORAGE YARD	GTW 5	2	-
ROPAK CAN AM	GTW 6	2	ROPAK SUPPLY WELL

ROPAK CAN AM	GTW 7	3	ROPAK RETURN WELL
SURRETTE BATTERY	GTW 8	1	SURRETTE RETURN WELL
SURRETTE BATTERY	GTW 9	2	TARGET MISSED
SURRETTE BATTERY	GTW 10	2	SURRETTE SUPPLY WELL
PIZZA DELIGHT	GTW 11	7	-
PIZZA DELIGHT	GTW 12	6	11 & 12 SUP/RETN
INDUSTRIAL PARK	GTW 13	2	POOR WELL, DIST RETN
INDUSTRIAL PARK	GTW 14		#4 SLOPE DIAMOND DRILLED
INDUSTRIAL PARK	GTW 15		#4 AIR SLOPE,DIAMOND DRILLED
INDUSTRIAL PARK	GTW 16		#4 MINE DIAMOND DRILLED

Eight GTW wells are connected to industrial and commercial buildings which include the installation of over 40 heat pump units. All wells continue to be monitored and static water levels confirmed.

4.1 MINE WATER TEMPERATURE

Water temperatures of 21.0 degrees C. have been recorded from exploration holes in the area. It was concluded that much of the heat is due to deep gradients together with the possibilities of exothermic reaction within the mines.

During the past century of mining in this area exothermic chemical reaction due to exposure of pyrite and coal to oxygen are expected to be producing some of the heat.

During the pumping of test well number 3 the mine water temperature rose to 18.0 degrees C. at the pump discharge and a temperature of 21.0 + degrees) was recorded at the pump inlet or mine shaft. Well temperatures at GTW 1 and GTW 2 were recorded at 11.5 C. and 13.8 C. respectively.

Temperature performance of wells located a distance from the main haulage of each mine was lower than the temperature recorded near the main haulage area. This is attributed to the surface cooling affect from the upper levels and passages which, in most cases, are 40 metres from surface. Cooler surface groundwater contamination was also found during pumping tests of the number 3 GTW.

During the well drilling of GTW 2 it was discovered that a cold water table was present just above the mine void and when entry to GTW 2 was made the cooler potable water flowed into the mine shaft. This well was later sealed or cased to prevent contamination between the two resources.

4.2 MINE WATER CHEMISTRY

The mine water in the early tests were not found to be excessively corrosive. The pH reading was near neutral (6.8 to 7.4 range) and alkalinity was high (670 mg-L) with little dissolved oxygen or hydrogen sulphide found in the mine water (0.1 mg-L and less).

The Langlier Index, a measure of the degree carbonate saturation of the ground water often used to assess scale or corrosion tendency, averaged +0.65 at 20 degrees C. suggesting a minor scale forming potential, and would be in the order of +0.25 for ground water temperatures of 5 to 7 degrees C. at the discharge end of a heat pump system in the heating mode, and 1.2 at 50 degrees C. for a system in the cooling mode.

The use of Cupronickel in the heat exchanger design materials was recommended and is still proven a normal practice today due to the ability of the material to inhibit scale build up with the tendency of the material to expand and contract during heat exchange.

The most important aspect of the chemical make up of the mine water, from the practical perspective of the operation of the system and the reinjection of the water, will be associated with iron. Iron exists in the mine water in quantities analyzed at approximately 22 mg-L total iron as Fe, predominantly occurring as Fe^{2+} (aq) (16.1 mg-L) and $FeSO_4$ (aq) (15.7 mg-L). Calculations of potential iron precipitation under various thermodynamic conditions suggested that if exposed to the atmosphere, likely all of the sulphate complexed iron would precipate in the form of iron oxide.

The above considerations suggested that there could be significant problems with reinjection of the mine water to the wells if the stream became oxidized prior to injection.

Clogging of the aquifer or injection well by iron, carbonate and silicate scale has been prevented by the establishment of procedures in piping system that prevent any contamination of the resource.

The return lines of the heat pump system are also carefully extended to below water levels to again prevent oxygen contamination.

A total of 16 GTW's are drilled from surface into the abandoned coal mines below Springhill and in total provide a comprehensive profile as to the chemical, temperature and strata characteristics of the reserve.

In consideration of all findings, five sites are connected to the geothermal minewater system and are listed as follows:

ROPAK CAN AM LTD	PLASTIC MFG PLANT
PIZZA DELIGHT RESTAURANT	COMMERCIAL PROJECT
M.B.B. MECHANICAL	LARGE BOILER MFG.
SURRETTE BATTERY LTD	BATTERY MANUFACTURING
G.O.V.R.C.	VOCATIONAL LEARNING CENTRE FOR HANDICAPPED

The above users of geothermal energy are listed in order of their connection to the system and in total over 40 heat pumps are used in the 5 sites.

5. GEOTHERMAL SITE 1. ROPAK

Ropak Can Am Ltd. is located in the Springhill Industrial Park and is one of the largest employers within the community providing employment for approximately 100 persons.

Plastic injected moulded products are manufactured at this facility and include products for the fishing, farming, agriculture and consumer use.

In late 1988 a decision was made to expand the existing 6039 square metre facility by an additional 7432 square metres. The decision to expand the present facility in Springhill followed negotiations with Town officials and owners of the Ropak plant. Geothermal energy was offered to this industry th help offset rising production costs and following acceptance of the plan work began both on expansion of the structure and development of geothermal technology for this facility.

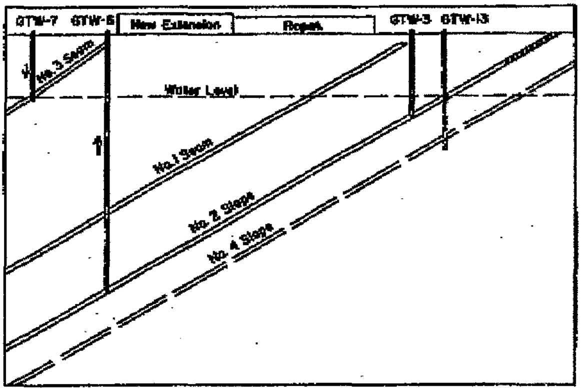

Figure 4

During negotiations a review of the potential operating cost savings was carried out. This study also identified that by utilizing the number 2 seam, which is located below the Ropak plant, cost savings of 70% were possible.

In January 1989 two geothermal wells were surveyed by the Nova Scotia Dept. of Natural Resources, Engineering Division, followed by drilling of the two production wells by the Town of Springhill. The supply well (GTW 6) was drilled to a depth of 136.3 metres where entry to the main haulage of the number 2 mine was gained. A seven day pump test was carried out and water samples and water temperatures were taken. Mine water temperatures of 20.1 degrees C. were recorded within the shaft and water chemistry was within acceptable limits. A return well (GTW 7) was then drilled into the number 3 haulage to a depth of 29.7 metres which was also located within close proximity to the Ropak plant and in February 1989 plastic connecting lines were finally run into the new Ropak expansion.

Selection of the initial heating equipment was made by the owner and the purchase of 11 "DELTA" heat pumps at a cost of $110,000 was awarded to Delta Heat Pumps Ltd., Amherst, N.S. The heat pumps selected were in consideration of the new facilities requirements for processing equipment dehumidification which would have cost the owners of Ropak an additional $70,000 above other forms of conventional heating means.

In March 1989 the new Ropak extension was completed and the installation of the 11 heat pumps began. The units are ceiling hung and each is equipped with down flow diffusers. Connection to the mine water piping is a parallel/series configuration in that two units are in series with one another and these two units are fed in a parallel piping arrangement via a common supply and return header. One heat pump, which is connected to the staff washrooms/rest rooms is connected between the two headers and not in a series loop. This unit provides domestic hot water in addition to heating for staff use. By the end of March 1989 the new addition was completed and the geothermal system was put into operation. Both heating and air conditioning are provided to this now modern facility. Monitoring of the geothermal system has been on going and energy cost saving dollars are tabulated which confirm the anticipated savings.

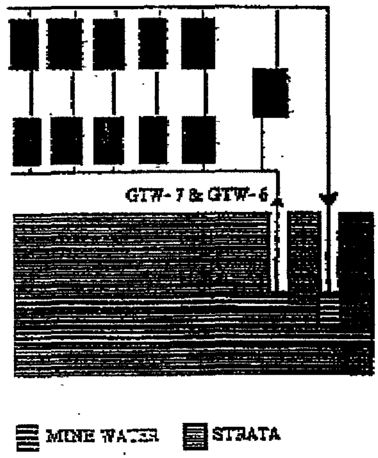

Figure 5

Geothermal heatpump connection and heat pump configuration. Ropak Can Am Limited, Springhill Industrial Park, N.S.

Separate electrical metering is installed by the owner and at the end of the first year of operation an annual EKWH/F2 consumption of 4.84 KWH's was calculated. Furthermore this small operating cost included both heating and air conditioning.

Additional benefits from the geothermal system that have resulted in dollar savings to the owner are:

- reduced maintenance costs
- reduced down time
- improved plant production at 9.0%
- improved staff morale with improved working conditions

These combined savings have resulted in an energy reduction of $15,000 for 1989 in comparison to the previous year of operation even though the plant size increased. Furthermore, savings in capital equipment purchases, dehumidifiers, etc., compound the total savings to the owners calculation of $165,000 in the first year of operation.

The direct electrical saving for the first year is represented by a kilowatt hour reduction as follows:

TABLE 2

YEAR	ENERGY COST	ENERGY USE
1988	$309156.00	total elect billing
	$ 12100.00	fuel oil heating
1989	$295955.00	total elect billing
	$ 10198.00	fuel oil, old section
Total savings	$ 15103.00	

Note: Fuel oil heating still in operation within old section of manufacturing plant in 1989.

As indicated, the total energy consumption for the Ropak plant dropped by $15,103.00 yet an additional 7432 square metres of geothermally heated/conditioned space was added in 1989.

As a result of the geothermal application at the Ropak facility they were awarded the 1990 Province of Nova Scotia Energy Award.

5.1 GEOTHERMAL SITE 2, PIZZA DELIGHT

A second site was chosen for demonstration of the geothermal technology in 1990 at a new "Pizza Delight" family restaurant. This site was chosen to demonstrate the commercial application rather than the industrial application of geothermal energy. Also because of the business district location, this location would serve as a study site for any further considerations towards a District Heating scheme.

Located on the "main street" district of the Town of Springhill, the new restaurant began construction in January 1990 and was completed by April of the same year.

Two geothermal wells (GTW 11 & GTW 12) were drilled into the abandoned number 6 and number 7 coal mines which lay directly below the new establishment. Well number 11 was drilled to a depth of 493 feet and was later selected as a return well. This well intersected the top number 7 seam at 396 feet but due to the absence of a large open cavity, drilling down to the lower number 6 seam became necessary.

The supply well (GTW 12) was drilled to a depth of 391 feet where connection to the number 7 mine void was attained. As with all other wells, water chemistry, quantities and temperatures were recorded towards final heat pump selection.

Located on adjoining town owned property, the two geothermal wells at the Pizza Delight Restaurant were connected to the new facility and the system was put into operation by April 1990. System performance is compiled for energy dollar savings.

The following table provides a cost comparison with two other new Pizza Delight operations which have almost identical equipment but operate on an air-to-air heat pump.

TABLE 3:

	TRURO	DIGBY	SPRINGHLL
Size	3200	2300	2800
Insulation	Above avg.	Above avg.	Below avg.
Energy source	Air to Air heat pumps with elect. heat backup	Air to Air heat pumps with elect. heat backup	Water to air geothermal heat pump
Elect energy annual cost	$21,170	$15,330	$10,402
Cost per square foot	$6.61	$6.66	$3.71

5.2 GEOTHERMAL SITE 3

M.B.B. Mechanical Services Ltd., a leading Canadian boiler construction and maintenance company, manufactures pressure parts such as superheaters, economizers, headers and generator tubes. The company doubled its size in late 1990 and made the decision to link its operation to geothermal energy.

Connection to a supply well (GTW 3) was made through a 500 foot trench which linked this facility to both a supply well and to a return well (GTW 13) which was drilled by the Town of Springhill. Because of the distance between wells and building a decision was made to size a buried lines to handle other potential users of geothermal minewater.

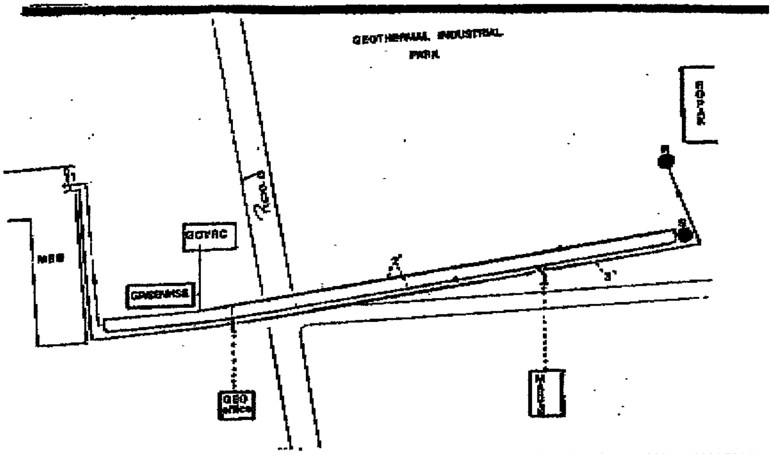

Figure 8

M.B.B. Mechanical invested over $100,000 in 10 heat pumps and after the first year of operation the company realized a savings of $50,000 plus productivity increased 15%.

MBB Mechanical Ltd., received the CBA's Industrial Award in 1992.

5.3 GEOTHERMAL SITE 4, SURRETTE BATTERY LTD.

Surrette Battery Ltd. made the decision to connect to geothermal energy in late 1992. This facilities' manufacturing process involves the use of dangerous materials, Surrette needs to change the air in its plant 11 times an hour. Before geothermal, each time the plants air was changed the boiler became less effective and the plant became cold in the winter.

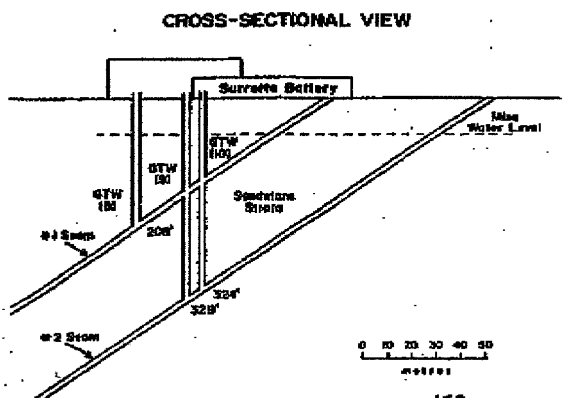

Figure 7

A total of three wells were drilled and two were later selected.

for final connection (GTW 8 & GTW 10) in November 1992. 12 heat pumps are connected to the system and operational performances are being monitored for future reference.

5.4 GEOTHERMAL SITE 5. G.O.V.R.C. WORKSHOP

The G.O.V.R.C. Workshop, located in the Industrial Park has been the most recent connection to the geothermal system (Dec 1992). Three heat pumps in total are connected to the pipeline running to MBB Mechanical building thus forming what is now considered a geothermal district heating system.

The G.O.V.R.C. Workshop is a vocational training centre for mentally handicapped adults. This facility also produces saleable products such as wooden shipping pallets, surveying stakes and numerous other wooden products. Garden flowers are also grown at this facility for resale.

While two of the heat pumps are connected to the main building, one of the heat pumps is installed in the greenhouse and will provide valuable information towards industrial attraction.

6.0 CONCLUSIONS

Five geothermal demonstration systems are presently in operation within the Town of Springhill, N.S. and are operating with complete owner satisfaction. Warm mine water is pumped from one mine and the heat is removed before being sent back to another mine shaft. This now cooler water sinks into the depths of the shafts where it regains its heat, rises up the shaft and the cycle repeats again.

The operation is simple and the principle provides the additional benefit of environmentally clean energy for the user. A much valued resource in comparison to numberous other forms of energy.

Recent studies of the Springhill geothermal mine water system have centered on the possibilities of establishing a District Heating System for the main business area of the Town. Various configurations and multiple building connections are being considered by the Town Officials which could prove beneficial to the users.

Capital and long term operating costs are but two factors that will have to be determined should such a project proceed on an economical footing.

The application of geothermal minewater technology first began in Springhill, N.S. but already other areas of the province and Canada are developing mine water geothermal plans for their areas.

Springhill will continue to research this new technology with a long term goal of providing continuing jobs for the town and the community.

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