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THE URGENCY AND IMMEDIATE SIGNIFICANCE OF CONSTRUCTING A 1 MW GEOTHERMAL DEMONSTRATION POWER PLANT IN NAGQU, XIZANG (TIBET)

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Nagqu Prefecture is located in the North Tibet Plateau at an average altitude of above 4500 m above sea level; it has a total area of 400,000 km^2 and a population of 200,000. This means that the population density is less than 1 person per square kilometer. The administrative office of this prefecture is set up in Nagqu town which is a political, cultural, economic and traffic center of the North Tibet plateau. Close by the Qinghai-Xizang highway and petroleum pipeline, Nagqu town has made much progress during the last years. Its permanent inhabitants have increased up to 15,313. This town begins to take shape, in which two elementary, one middle and one pedagogical and a nurse's school have been established, animal husbandry, handicraft and the country fair trade have developed also to some extent. Nevertheless, the problem in the local energy enterprise still remains unsolved, due to the past socio-historical and natural factors. There are only 10 diesel generators with a total nominal capacity of 1.68 MW. The electricity from these units can only satisfy the lighting needs of the local organization and some inhabitants, lasting only 4 to 5 hours every night due to high production cost. The others have to light their houses with candles or buttered lamps. This shortage seriously restricts the further progress in local economy. For this reason, the energy problem in Nagqu must be solved as a strategical one, and the Government of Xizang Autonomous Region has invested RMB 6 millions for Nagqu's geothermal exploration and drilling. This has yielded some positive results. Recently the UNDP intended to construct a 1 MW geothermal binary-cycle demonstration unit in Nagqu Town, which is greatly welcomed by the local inhabitants. We hope the combined investments from UN and Chinese Government may reap rich fruits, and would like to summarize the feasible and practical conditions for constructing a geothermal demonstration power plant as follows:

1. The local geothermal resource is reliable. A total of 18 drilled holes have now been completed in Nagqu town by the Geothermo-geological Brigade of Xizang Bureau of Geology Mineral Resources. These boreholes cover an area of about 10.1 km^2, of which the high-temperature one makes up 0.6 km^2. Four wellbores (ZK 1005, 1004, 1203 and 1303) may be used for test production. These wells were completed with a diameter of 95/8", and all discharged about 200 t/h; the measured maximum temperature was 115.8 C, while the wellhead temperature was 110-113°C. The total flow from these four wells during discharge testing was measured as 1051 t/h. Based on a preliminary calculation of the potential power-generation, a total of 3-4 MWe might be installed, if the binary-cycle units were adopted.

2. The geothermal reservoir has good potential for exploitation. The wellbore ZK 1303 was put into heating use since September 1985. The heating period in Nagqu town lasts as long as 9 months every year, and the average flow from ZK 1303 was 120-150 t/h, and its temperature, pressure and discharging flow remained basically unchanged, while the multiwell discharging test was carried out in 1988. The pressure in ZK 1303 recovered rapidly (only 7 months), although this test lasted as long as 6 days. This character was reconfirmed by some Aquater experts during their investigation in-site in 1989. The Chinese and Italian experts were of the same view that the pressure of the fluid within the drillhole might recover rapidly so long as drillholes were located in the upwelling pathway of the deep fluid.

3. An ideal cooling condition exists in Nagqu. For example, the multi-annual mean air temperature is -1.9°C, the extreme maximum air-temperature was 22.6°C (on July 15, 1972), while the minimum was -41.2°C (on January 16, 1968). According to the calculations of the Chinese and American experts from Ben Holt Company, the specific consumption of hot water may be 0.25 t/kwh, if the air cooling system were adopted. This advantage may be greater in a cold winter. It is expected that only a single wellbore with well designed parameters may produce the energy needed for a 1 MW unit.

4. The partial environmental change may-not exert significant impact to human activity, because the Nagqu Prefecture is vast in territory and sparsely populated. Furthermore, the geothermal field to be developed is located just within a saline-alkali depression, with a capacity of about 3.4 x 10^7 m^3. This figure means that this depression might be all filled only after 15 years, if the hot effluent were 250 t/h. The evaporation and seepage have not been taken into account in this rough estimation. In fact, the local annual evaporation loss was as high as 1800 mm. Thus there is no need to worry about contamination along the banks of Nagqu River.

5. The power-generation unit is relatively compact and easy to move. The main equipment of this unit may be assembled with two standard containers. This unit could be easily be removed to another geothermal field (for example, Yanybajain or Yangyi), whenever the resources of Nagqu were unfavourable or the production wells were affected by accident or failure.

6. The Nagqu geothermal power-generation unit has considerable demonstration significance. Several tens of geothermal fields with the same or similar dimension and parameters as Nagqu occur in the Tibet plateau. It is expected, on the one hand that the selection of the Nagqu geofield may reduce the local shortage of energy source; on the other hand, this may spread the Nagqu's experience over other areas covered by the regional elecmcal networks. Thus, it is worth putting some human and material resources on the construction of the Nagqu geopower plant.

In order to ensure successful completion of this plant, the following works are urgent and necessary.

1. Selection of a favourable downhole pump. It is easy to select such a downhole pump for the Nagqu geopower plant due to the relatively low temperature of the fluids discharged. It is suggested that the submersible pump used in Wabuska Geopower Station, Nevada, United States, could be applied to Nagqu also. All one has to do is extend its applicable range of flowrate and temperature (for example, more than 210°C). Such a pump could be generally used in other geothexmal fields. According to information available, the hydraulic-drive downhole pump system made by Weir Pump Ltd, UK, might be competent to do this job.

2. A comparison between the air and water cooling systems indicates we would prefer the air-cooling system due to the Nagqu's physical conditions. This system could improve the generation efficiency for each ton of hot water, particularly in a cold winter, although the temperature of cooling water may be as low as 0°C. The maintenance of an air-cooling system is relatively easy, while the increase of auxiliary power might be limited. In fact, the once-through water-supply system may not be applied to Nagqu. The de-icing operation might arise when the cooling tower was introduced into the Nagqu Geopower Plant. In addition, the assemblies within this tower were easily to be damaged by a strong wind. This situation did occur in Yangbajain Geopower Plant. A fountain pond might be suitable, if the water-cooling system was decided upon.

3. Close attention must be paid to research on anti-corrosion and anti-scaling.

To sum up the above, it is considered both urgent and practical to install a 1 MW geothemal demonstration power plant at Nagqu.