

SETTING UP OF GEOTHERMAL POWER PLANT AT PUGAH LEH

An expert Group under Chairmanship of Member (Planning), CEA was set up by MNRE to examine and compile information available with various agencies in respect of Pugah Geothermal fields, assess the potential and prepare an action plan for development of this potential, explore multipurpose utilization for improving viability of the project, evacuation of power and its utilization and source of funding. The expert Group carried out many activities in the form of meeting/interactions with the expert and a Site visit to Pugah. A team visited Leh/Ladakh and the Pugah site during 11th November to 14th November, 07. During the visit, discussions were also held with the Ladakh Autonomous Hill Development Council and the Army Authorities of the area so as to assess the present and future demand and the existing resources. Information available from the detailed exploratory studies carried out in Pugah over the past more than three decades by GSI, ONGC, NGRI, MECL, CEA and IIT, Kanpur was examined and collected by the Expert Group.

Other organizations like M/s GeoSyndicate who did not share their data with the Expert Group due to IPR issues, have also indicated that the deep reservoir temperature has been calculated to be 289° C but in order to assess potential for power generation, deep drilling shall have to be undertaken. NHPC with the help of an International consultant viz.M/s Geothermex Inc. USA have also estimated Pugah's Reserves as 19 MW with 90% probability of generating power for 30 years.

Detailed exploratory studies have been carried out in the Pugah over the past more than three decades. The site investigations have been carried out by GSI, ONGC, NGRI, MECL, CEA and IIT, Kanpur, between the period 1973-2001. Geological, geochemical, geophysical and drilling investigations carried out by the GSI, NGRI and other organizations have resulted in a wealth of information on subsurface features, reservoir characteristics and the possible potential of these geothermal fields, particularly Pugah.

GSI, CEA, NGRI and NHPC have been involved with the geothermal exploration, particularly in Pugah valley, Ladakh, J& K, since 1973 and a wealth of multidisciplinary data have been generated. As far as surface

studies on geological, geophysical and geochemical aspects and subsurface exploration to relatively shallow depth are concerned, Pugah is definitely the most "well understood" geothermal field of the country.

MN&RE has been supporting a research, development and demonstration programme for utilization of geothermal energy for power generation and direct heat applications and has demonstrated its use at some locations in the Country. Deep reservoir temperature assessment of potential sites at Pugah in J&K and Tatapani in Chattisgarh have also been carried out through Magneto Telluric Investigations assigned to NGRI, Hyderabad.

The investigations have resulted in a wealth of information on subsurface features, reservoir characteristics and the possible potential of this field, main findings of which are presented briefly as follows:-

- Pugah in the most promising geothermal field of the sub-continent from the point of view of electric power generation.
- In the field, the geothermal anomalous area with over 100 hot springs is about 5 squarekms bounded by Zildat fault in the east and Kiagar Tso fault in the west. It is this area which is accessible for drilling of production wells for power generation.
- The 17 producing wells out of 34 wells drilled in the valley produce from the shallow reservoir are hosted by a 'breccia' type rock generated due to in duration of morainic material.
- In light of the available geochemical and geophysical data, the shallower reservoir is fed by a deeper reservoir at temperature definitely in excess of 230⁰ C.
- The highest bottom hole and discharge temperature are 28⁰ and 140⁰ C, respectively. Discharge pressure in good wells is 3 kg/cm².
- The data obtained after drilling when projected to deeper levels indicates that estimated deep reservoir temperature in excess of 220⁰ C are estimated by GSL and NGRI and about 239⁰ C by M/S Geo Syndicate. The shallow reservoir may yield temperature of 180⁰ C.
- Cumulative discharge from 17 producing wells is 300 tons/hr. Eight good out of these 17 have a cumulative discharge of 190 tons/hr.
- The steam content is borehole discharges varies from 10 to 20%.
- Seventeen producing wells have a cumulative discharge of 300 tons/hr. With steam content of about 10% the stream would be 30 tons/hr (considering cumulative discharge by joining all the flowing

wells), and 1.5 to 2 MW of power would be generated. (Normally, 10 tons/hr of steam is required for generating 1 MW at 100° to 140° C but as Pugah steam is likely to be at an average temperature of 100° to 115° C). Also binary plant uses 20 tons/hr. of thermal discharge per MW generation and considering this, Pugah has a proven potential of generating 1.5 MW using a binary plant.

- Chemistry of thermal discharges is relatively uniform. Hot springs and borehole discharges are Na-HCO₃- Cl type with little quantitative variation in major cations and anions. This indicates that all discharges owe their origin to a single reservoir and that there is a subsurface mixing and stirring of geothermal fluid. This is also an indication of better permeability conditions.
- A number of boreholes drilled during 1973 to 1976 threw up silica gel as the initial discharge. This unequivocally proves much higher temperatures (160-180 ° C) in the shallow aquifer itself.

Vide Government Order No: - 144-PDD of 2009 dated 23-6-2009, it has been decided that JKSPDC will develop geothermal energy resource in Pugah, Leh for electrical energy generation through Independent Power Producer (IPP) on BOOT basis. The selection of developer will be based on a transparent and publicized criteria by adopting tariff based competitive bidding process so that drilling is conducted by the IPP at least upto 2000 meter depth so as to exploit greater potential in a time bound manner for delivery of electrical energy by IPP to Power Development Department at Leh town for further distribution.

The expert group has recommended that the exploitation of geothermal potential at Pugah must be expedited through a two pronged approach for which both a short term and long term action plan needs to be evolved. The short term would envisage reviving of existing borewells and combine the discharge to run a binary plant or alternatively drilling of 2-4 wells each of 500 meters depth in the vicinity of the existing borewells to produce 3-5 MWs of power from consolidated discharge. Long term action plan would envisage drilling of two no 2000 meters deep production wells to tap the geothermal potential of deep reservoir.

Against the backdrop of the studies conducted by various agencies, report of the expert group and the prospect of good potential of the Pugah valley site , it has been decided by the State Government that Jammu & Kashmir

State Power Development Corporation Limited(JKSPDCL) shall install a Geothermal Power Plant at Pugah,Leh,by drilling at least 2000 meter borewell through IPP selected by International Competitive Bidding route. The mandate for the Successful Bidder would be to develop the Geothermal Power Plant on Design, Build, Own & Operate (DBOO) basis.

However, It is felt that JKSPDC shall require the services of a Consultant for guiding JKSPDC through the entire bidding process. The Consultant is proposed to be engaged through competitive bidding process.

In this regard a conference of potential consultants is proposed to be organised tentatively in November to get a better understanding of the requirements and available competencies. Interested Consultants shall make a half an hours presentation about their strengths, way forward and of course their valuable suggestions.

Confirmation to participate in the conference and make presentation may be sent by 28th October 2010 to JKSPDC through fax/email on the following:-

Fax : 0194-2483578, 0194-2451665

E mail : jkspdcl@gmail.com