Geothermal Energy in India : Past , Present and Future Scenarios

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India has huge potential to become a leading contributor in generating eco-friendly and cost effective geothermal power. Around 6.5 per cent of electricity generation in the world would be done with the help of geothermal energy and India would have to play a bigger role in the coming years in this direction. But, the power generation through geothermal resources is still in nascent stages in India. Geological Survey of India has identified about 340 geothermal hot springs in the country. Most of them are in the low surface temperature range from 37oC -90oC which is suitable for direct heat applications. These springs are grouped into seven geothermal provinces i.e. Himalayan (Puga, Chhumathang), Sahara Valley, Cambay Basin, Son-Narmada-Tapi (SONATA) lineament belt, West Coast, Godavari basin and Mahanadi basin. Some of the prominent geothermal resources include Puga Valley and Chhumathang in Jammu and Kashmir, Manikaran in Himachal Pradesh, Jalgaon in Maharashtra and Tapovan in Uttarakhand. A new location of geothermal power energy has also been found in Tattapani in Chhattisgarh. In addition, Gujarat is set to tap geothermal electricity through resources which are available in Cambay between Narmada and Tapi river. Puga, which is located at a distance of about 180 km from Leh in the Ladakh region of Jammu and Kashmir across the great Himalayan range, is considered to be a good potential of geothermal energy. In Puga valley, hot spring temperatures vary from 30oC to 84oC (boiling point at Puga) and discharge up to 300 liters /minute. A total of 34 boreholes ranging in depths from 28.5 m to 384.7 m have been drilled in Puga valley. Thermal manifestations comes in the form of hot springs, hot pools, sulphur condensates, borax evaporates with an aerial extent of 4 km. The hottest thermal spring shows a temperature of 84oC and the maximum discharge from a single spring is 5 liters /second. Chhumathang spring is another geothermal area located about 40 km north of Puga. The thermal water from Chhumathang is quite similar to the thermal waters at Puga except the difference that its water has relatively higher pH and sulphate. Geothermal activity at Manikaran occurs in the form of hot springs over a distance of about 1.25 km on the right bank of Parvati river with a temperature range of 34oC-96oC whereas on the left bank over a distance of about 450 m with a temperature range of 28oC-37oC. At Tapovan geothermal area, the highest temperature recorded is 65oC. from this spring varies between 0.83-9.2 litre/second. Similarly, Tattapani is a promising geothermal resource in Peninsular India. Thermal manifestation at Tattapani is very intense in an area of 0.05 sq. km with several hot spots, hot water pools and marshy land. The surface manifestations show occurrence of white to dirty white deposits identified as silica and moderate to low sag activity. Sixty thermal water springs occur at eighteen localities in the West Coast hot spring belt. One geothermal power project has a capacity of 25MW. Himurja, Himachal Pradesh has decided to select some geothermal resources in Beas valley, Parvati valley, Satluj valley and Spiti valley in Himachal Pradesh for deep drilling up to 2 km for exploitation of geothermal energy. There is an imminent need to explore the possibility of setting up more geothermal power plants to use the naturally occurring renewable source of energy in India.

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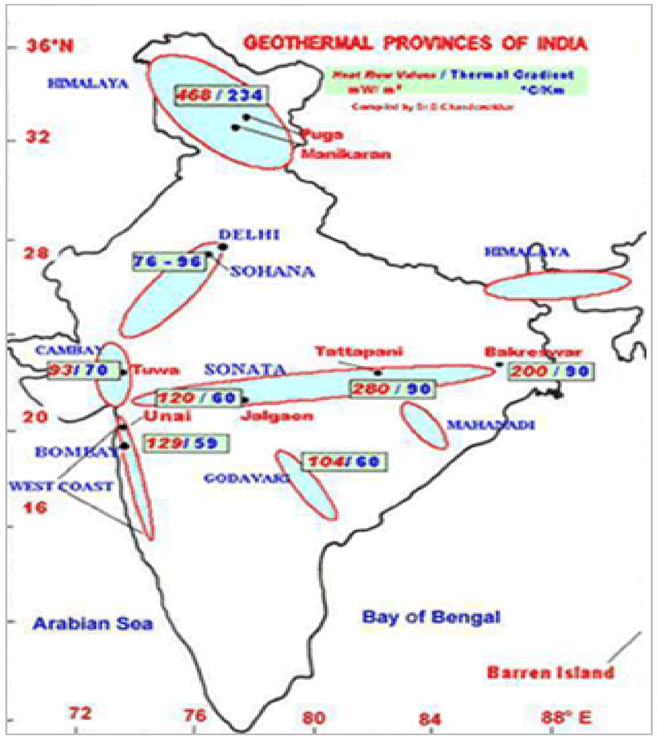
Abstract

India has huge potential to become a leading contributor in generating eco-friendly and cost effective geothermal power. Around 6.5 per cent of electricity generation in the world would be done with the help of geothermal energy and India would have to play a bigger role in the coming years in this direction. But, the power generation through geothermal resources is still in nascent stages in India. Geological Survey of India has identified about 340 geothermal hot springs in the country. Most of them are in the low surface temperature range from 37oC -90oC which is suitable for direct heat applications. These springs are grouped into seven geothermal provinces i.e. Himalayan (Puga, Chhumathang), Sahara Valley, Cambay Basin, Son-Narmada-Tapi (SONATA) lineament belt, West Coast, Godavari basin and Mahanadi basin. Some of the prominent geothermal resources include Puga Valley and Chhumathang in Jammu and Kashmir, Manikaran in Himachal Pradesh, Jalgaon in Maharashtra and Tapovan in Uttarakhand. A new location of geothermal power energy has also been found in Tattapani in Chhattisgarh. In addition, Gujarat is set to tap geothermal electricity through resources which are available in Cambay between Narmada and Tapi river. Puga, which is located at a distance of about 180 km from Leh in the Ladakh region of Jammu and Kashmir across the great Himalayan range, is considered to be a good potential of geothermal energy. In Puga valley, hot spring temperatures vary from 30oC to 84oC (boiling point at Puga) and discharge up to 300 liters /minute. A total of 34 boreholes ranging in depths from 28.5 m to 384.7 m have been drilled in Puga valley. Thermal manifestations comes in the form of hot springs, hot pools, sulphur condensates, borax evaporates with an aerial extent of 4 km. The hottest thermal spring shows a temperature of 84oC and the maximum discharge from a single spring is 5 liters /second. Chhumathang spring is another geothermal area located about 40 km north of Puga. The thermal water from Chhumathang is quite similar to the thermal waters at Puga except the difference that its water has relatively higher pH and sulphate. Geothermal activity at Manikaran occurs in the form of hot springs over a distance of about 1.25 km on the right bank of Parvati river with a temperature range of 34oC-96oC whereas on the left bank over a distance of about 450 m with a temperature range of 28oC-37oC. At Tapovan geothermal area, the highest temperature recorded is 65oC. from this spring varies between 0.83-9.2 litre/second. Similarly, Tattapani is a promising geothermal resource in Peninsular India. Thermal manifestation at Tattapani is very intense in an area of 0.05 sq. km with several hot spots, hot water pools and marshy land. The surface manifestations show occurrence of white to dirty white deposits identified as silica and moderate to low sag activity. Sixty thermal water springs occur at eighteen localities in. Onegeothermal power project has a capacity of Coast hot spring belt25MW. Himurja, Himachal Pradesh has decided to select some geothermal resources in Beas valleatluj valley and Spiti valley in Himachal Pradesh for deep drilling up to 2 km for exploitation of geothermal energy. There is an imminent need to explore the possibility of setting up more geothermal power plants to use the naturally occurring renewable source of energy in India.

Discussion

Major geothermal energy resources in India

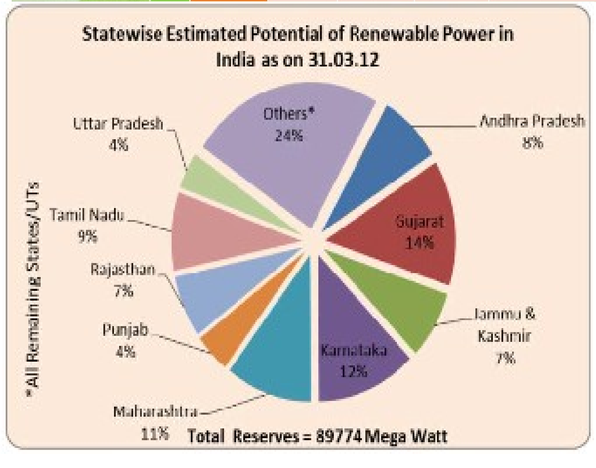


Geothermal Potential in India

India is blessed with good potential for geothermal energy. India is considered to have Low (<100 Degree C) to medium (100- 200 Degree C) enthalpy regions. Surveys done by Geological Survey of India have earmarked 340 hot springs within temperature range of 34 Degree C to 98 Degree C. The major potential areas for geothermal energy (both thermal and power) in India are identified as under:

Potential sites

Province	Surface Temp C	Reservoir Temp C	Heat Flow	Thermal gradient
Himalaya	>90	260	468	100
Cambay	40-90	150-175	80-93	70
West coast	46-72	102-137	75-129	47-59
Sonata	60 – 95	105-217	120-290	60-90
Godavari	50-60	175-215	93-104	60



Present and Future Scenarios

Some of the major companies planning to enter/entering the geothermal energy area in India are here under:

1.Tata Power-Tata power holds an 11.4 percent stake in Geodynamics Ltd.,, which is building a geothermal plant with Origin Energy Ltd. in Australia. The company plans to set up two 5 MW plants in the western state of Gujarat.

2.Thermax – It is a major publicly listed power equipment company. The company has a JV with Iceland-based Reykjavik Geothermal to explore the Ratnagiri region in western Maharashtra state. A pilot 3 MW Project is slated to be set up in Puga Valley in Ladak

3.Geosyndicate- It has already entered into a power purchase agreement (PPA) with Warangal-based Northern Power Distribution Company under the aegis of the Non- conventional Energy Development Corporation of Andhra Pradesh Limited (NEDCAP).The plant should come up soon with an initial capacity of 25 MW if the company can managed the financing of the cost of the $ 64.66 million plant in the Khammam district of Andhra Pradesh (AP).

4.**Panax Geothermal** – Panax is an Australian company which has tied up with Geosyndicate to develop a 60 MW plant in Puga, Himachal Pradesh. However the project is still in the very initial stage with permits .

5.Avin Energy – This is a small company which plans to develop a 5 MW plant in Gujarat. However it seems to being having difficulty in finding financing and seems to have changed its focus to solar energy.

6.NTPC– The government owned power utility has its fingers in all the energy pies in the country. The company had tied up with National Geophysical Research Institute (NGRI) to identify potential sites for geothermal power projects in the country but nothing has come up as of now.

Conclusion

India has massive energy needs and with a 15% energy requirement from clean sources by 2020,. It needs to develop all renewable sources. Geothermal Energy is regarded as a poor cousin to its more glamorous cousins Wind and Solar. However Geothermal Energy possesses one attribute that the others do not. Geothermal Energy in India like other places in the world is moving at a snail's pace due to project development and financing problems. India is capable of generating 10 GW which is the entire world's generating geothermal capacity. India proposes to harness 10,000 MW (10 GW) of geothermal energy by 2030 through active international collaboration with countries such as the US, Philippines, Mexico and New Zealand. However it needs strong government support and incentives along with financing to develop its potential

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