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FEASIBILITY OF TECHNOLOGY AND OPERATIONAL NECESSITIES IN TIDAL STREAM POWER GENERATION AND GEOTHERMAL ENERGY IN FURTHER DEVELOPMENT.

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Keywords: - Tidal energy, spring tide, neap tide, GPCL, Fahrenheit, mantle, Geothermal energy.

I. INTRODUCTION

Tidal power or tidal energy is the form of hydropower that converts the energy obtained from tides into useful forms of power, mainly electricity. Tides are the periodic motion of the waters of the sea due to the inter-attractive forces between the celestial bodies. Tides are very long-period waves that move through the oceans in response to the forces exerted by the moon and sun. Tide and current are not the same. Tide is the vertical rise and fall of the water and tidal current is the horizontal flow. In simple words, the tide rises and falls, the tidal current floods and ebbs. The principal of tidal forces are generated by the Moon and Sun. The Moon is the main tide-generating body. Due to its greater distance, the Sun's effect is only 46 per cent of the Moon's.

Geothermal energy is a renewable energy source because heat is continuously produced inside the earth. People use geothermal heat for bathing, to heat buildings, and to generate electricity. Thermal energy is energy that determines the temperature of matter. Earth's geothermal energy originates from the original formation of the planet, from radioactive decay of minerals, from volcanic activity, and from solar energy absorbed at the surface. The geothermal gradient, which is the difference in temperature between the core of the planet and its surface, drives a continuous conduction of thermal energy in the form of heat from the core to the surface.

II. GENERATION OF TIDAL ENERGY

In order to create enough electricity to be economically feasible, the size and configuration of the structure has to be increased tremendously. Tidal Energy consists of generating kinetic energy from potential energy. If falling water is forced through ducts with rotators attached to them, the rotors will turn driving electric generators. Generating electricity from tides is very similar to hydroelectric generation, except the tides flow in two directions rather than one. For tidal power, the most common generating system is the ebb generating system. In the scheme, a dam, or barrage is constructed across an estuary. The tidal basin is allowed to fill when the sluice gates are opened and high tide is in. The gates are then closed when the tide turns trapping the water behind the gates. Once low tide is reached, the gates are opened the water flows through the turbines located underneath the water generating electricity. In some cases, double effect turbines are used, which are able to generate electricity when then basin is filling. In this scheme, sluice gates located on either side of the turbine are opened, when the tidal basin is low, and the sea is at high tide level. Water will rush into the tidal basin, turning the turbines and generating electricity. This occurs until the water level on either side of the barrage is equal. At this point, the sluice gates are closed until the sea is at its low tide height. When this occurs, the gates are opened and water flows from the basin to the sea, generating electricity a second time.

Figure 1:- Rotation of Blades in Tidal Power Plants

III. TIDAL ENERGY IN INDIA

As of March 2017, India announced of its 7500 Km long coastline, where the height of high tide was recorded over 5 meters higher than the low tide which can essentially capture the potential tidal power. The Renewable Energy estimated that the country can produce 7000 MW of power in the Gulf of Khambhat in Gujarat, 1200 MW of power in the Gulf of Kutch in Gujarat and about 100 MW of power in the Gangetic delta of Sunder bans in West Bengal. The Gujarat government is all set to develop India's first tidal energy plant. The state government has approved Rs 25 crore for setting up the 50 MW plant at the Gulf of Kutch. It will produce energy from the ocean tides. According to the Gujarat Power Corporation Limited (GPCL) officials, if this 50 MW plant is successfully commissioned, its capacity will be increased to 200 MW. As per a study conducted by Atlantis Resource Corporation and the state government two years ago, the Gulf of Kutch has a total potential of 300 MW.

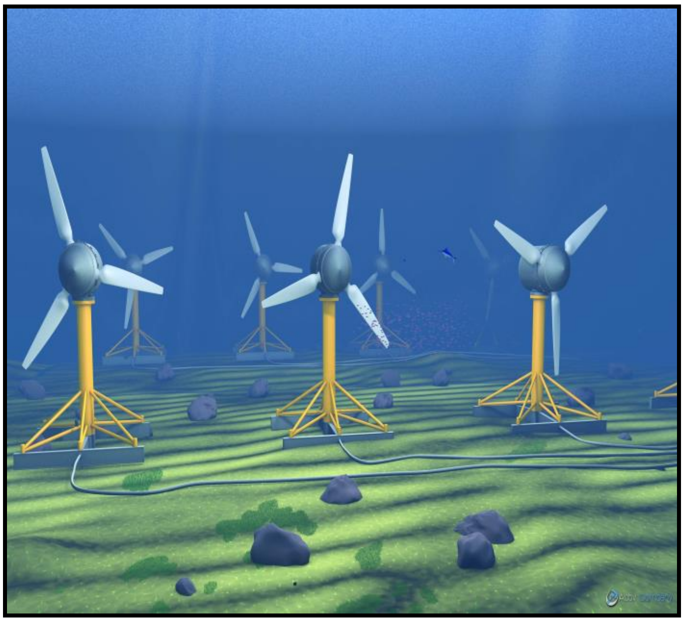

Figure 2:- Tidal Power Plants

The possible operating tidal power plants in India are shown in the following table:-

Place	Mean Tidal Range	Area of basin	Maximum Capacity
Kutch	5.3	170	900
Cambay	6.8	1970	7000

Table:-1 Maximum Capacity Range of Tidal Power Plants.

IV. India Lacks a Tidal Energy Policy

It is surprising that a country so well endowed with the potential of tidal energy, India does not have a tidal energy policy in place. It becomes critical to have a strong policy in place to have clarity on the commercial development as well as the tariff of the power generated through a particular type of energy source. A strong policy would be the first step towards generating interest among developers and getting the right focus towards development of tidal energy as an electricity source.

Though India has a potential to develop more than 8000 MW of electricity via tidal power, it is important to note that the projects which were planned earlier were abandoned due to high capital costs. Before looking at this renewable source of energy, India needs to consider factors like the environmental impact of these projects on the ecosystem, the transmission requirements of the electricity from coastal regions to the populated central part of the country as well as set in place a strong tidal energy policy to attract investors to projects.

V. Generation of GEOTHERMAL ENERGY

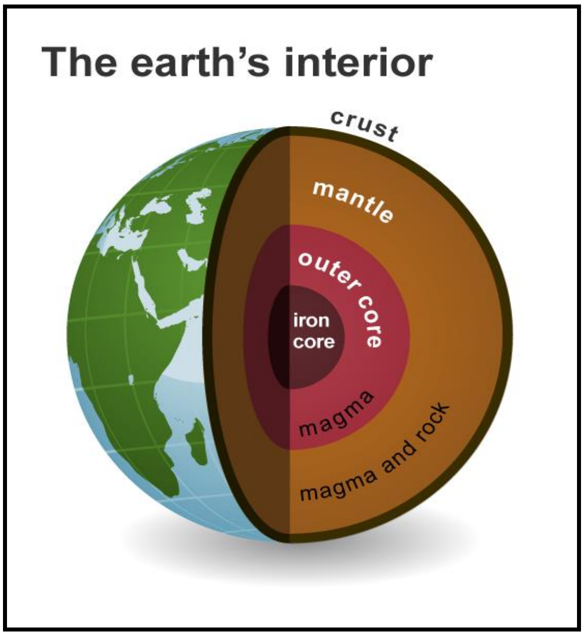

Figure 3:- Cross Section of the Earth Interior

The slow decay of radioactive particles in the earth's core, a process that happens in all rocks, produces geothermal energy. The earth has four major parts or layers:-

(1) An inner core of solid iron that is about 1,500 miles in diameter.

(2) An outer core of hot molten rock called magma that is about 1,500 miles thick.

(3) A mantle of magma and rock surrounding the outer core that is about 1,800 miles thick.

(4) A crust of solid rock that forms the continents and ocean floors that is 15 to 35 miles thick under the continents and 3 to 5 miles thick under the oceans.

The temperature of the earth's inner core is about 10,800 degrees Fahrenheit (°F), which is as hot as the surface of the sun. Temperatures in the mantle range from about 392°F at the upper boundary with the earth's crust to approximately 7,230°F at the mantle-core boundary.

The earth's crust is broken into pieces called tectonic plates. Magma comes close to the earth's surface near the edges of these plates, which is where many volcanoes occur. The lava that erupts from volcanoes is partly magma. Rocks and water absorb heat from magma deep underground. The rocks and water found deeper underground have the highest temperatures.

VI. ECONOMICS OF GEOTHERMAL ENERGY

Geothermal power plants can produce electricity as cheaply as some conventional power plants. It costs 4.5 to seven cents per kWh to produce electricity from hydrothermal systems. In comparison, new coal-fired plants produce electricity at about four cents per kWh. Initial construction costs for geothermal power plants are high because geothermal wells and power plants must be constructed at the same time. But the cost of producing electricity over time is lower because the price and availability of the fuel is stable and predictable. The fuel does not have to be imported or transported to the power plant. The power plant literally sits on top of its fuel source. Geothermal power plants are also excellent sources of base load power. Base load power is power that electric utility companies must deliver all day long. Base load geothermal plants sell electricity all the time, not only during peak use times when the demand for electricity is high. Until recently, utilities were required to buy the least-cost electricity, without regard to environmental impacts. Federal and state energy and environmental agencies are studying ways to give preference to nonpolluting energy sources such as geothermal energy.

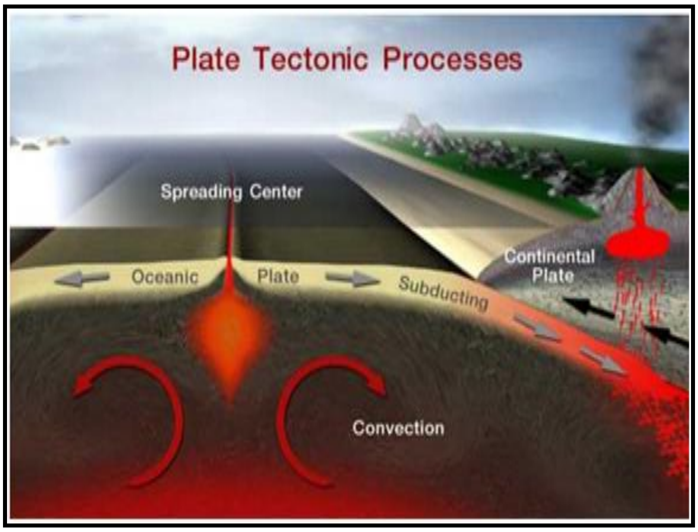

Figure 4: - Plate Tectonic Processes occur in Geothermal Energy

VII. GEOTHERMAL ENERGY IN INDIA

Geothermal energy is thermal energy, which is generated through the natural hot springs. In India, by the time, geothermal energy installed capacity is experimental; however, the potential capacity is 10,600 MW.

Following are the six most promising geothermal energy sites in India.

(1) Tattapani in Chhattisgarh
(2) Puga in Jammu & Kashmir
(3) Cambay Graben in Gujarat
(4) Manikaran in Himachal Pradesh
(5) Surajkund in Jharkhand
(6) Chhumathang in Jammu & Kashmir

Following are the six major geothermal provinces in India:-

(1) Himalayan Province e.g. Himachal Pradesh, Jammu & Kashmir, etc.
(2) Areas of Faulted blocks e.g. Aravalli belt, Naga-Lushi, West coast regions and Son-Narmada lineament.
(3) Volcanic Arc e.g. Andaman and Nicobar Arc (Barren Island).
(4) Deep sedimentary basin of Tertiary age e.g. Cambay basin in Gujarat.
(5) Radioactive Province e.g. Surajkund, Hazaribagh, and Jharkhand.
(6) Cratonic Province e.g. Peninsular India.

Potential Geothermal regions/sources in India:-

With India’s geothermal power potential of 10,600 MW, the following are the potential sources/ regions where geothermal energy can be harnessed in India.

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

Table:-2 Maximum Capacity Range of Geothermal Energy

VIII. CONCLUSION

The tidal energy industry has to develop a new generation of efficient, low cost and environmentally friendly apparatus for power extraction from free or ultra-low head water flow. The negative environmental impacts of tidal barrages are probably much smaller than those of other sources of electricity, but are not well understood at this time. It is important to consider the influence of energy extraction while estimating the available energy from a potential tidal energy site. The Earth’s geothermal resources are theoretically more than adequate to supply humanity’s energy needs, but only a very small fraction may be profitably exploited. Drilling and exploration for deep resources is very expensive. Forecasts for the future of geothermal power depend on assumptions about technology, energy prices, subsidies, and interest rates. Geothermal power is cost effective, reliable, sustainable, and environmentally friendly, but has historically been limited to areas near tectonic plate boundaries. Recent technological advances have dramatically expanded the range and size of viable resources, especially for applications such as home heating, opening a potential for widespread exploitation.

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X. References

[1] The International Journal of Ocean and Climate Systems, Volume: 8 issue: 2, page(s): 85-97 Article first published online: June 6, 2017; Issue published: August 1, 2017 Received: August 23, 2016; Accepted: January 22, 2017.

[2] Bryden I G, T. Grinsted, G.T. Melville, (2004) Assessing the potential of a simple tidal channel to deliver useful energy, Journal of Applied Ocean Research Volume 26, pp 198–204.

[3]Bryden I.G., Scott J.C.,(2006) ME1—marine energy extraction: tidal resource analysis, Journal of Renewable Energy, Volume 31, pp 133–139.

[4] Hammons, T. J. 1993, "Tidal power", Proceedings of the IEEE, [Online], v81, n3, pp 419–433. Available from: IEEE/IEEE Xplore. [July 26, 2004].

[5] Lund JW, Freeston DH, Boyd TL (2010) Direct utilization of geothermal energy 2010 worldwide review. In: Proceedings of world geothermal congress 2010, Bali, 25–29 Apr 2010.

[6] Chandrasekharam D (2000) Geothermal energy resources of India-Country update. In: Iglesias E, Blackwell D, Hunt T, Lund J, Tamanyu S, Kimbara K (eds) Proceedings of world geothermal congress 2000, pp 133–145.

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