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Comparative Analysis of Costs and Well Drilling Techniques for Water, Geothermal Energy, Oil and Gas Production

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Abstract : The development of society relies heavily on the total amount of energy obtained and its consumption. Over the years, there has been an advancement on energy attainment, which is directly related to some natural resources and developing systems. Some of these resources should be highlighted for its remarkable presence in world´s energy grid, such as water, petroleum, and gas, while others deserve attention for representing an alternative to diversify the energy grid, like geothermal sources. Therefore, because all these resources can be extracted from the underground, drilling wells is a mandatory activity in terms of exploration, and it involves a previous geological study and an adequate preparation. It also involves a cleaning process and an extraction process that can be executed by different procedures. For that reason, this research aims the enhancement of exploration processes through a comparative analysis of drilling costs and techniques used to produce them. The analysis itself is based on a bibliographical review based on books, scientific papers, schoolwork and mainly explore drilling methods and technologies, equipment used, well measurements, extraction methods, and production costs. Besides techniques and costs regarding the drilling processes, some properties and general characteristics of these sources are also compared. Preliminary studies show that there are some major differences regarding the exploration processes, mostly because these resources are naturally distinct. Water wells, for instance, have hundreds of meters of length because water is stored close to the surface, while oil, gas, and geothermal production wells can reach thousands of meters, which make them more expensive to be drilled. The drilling methods present some general similarities especially regarding the main mechanism of perforation, but since water is a resource stored closer to the surface than the other ones, there is a wider variety of methods. Water wells can be drilled by rotary mechanisms, percussion mechanisms, rotary-percussion mechanisms, and some other simpler methods. Oil and gas production wells, on the other hand, require rotary or rotary-percussion drilling with a proper structure called drill rig and resistant materials for the drill bits and the other components, mostly because they´re stored in sedimentary basins that can be located thousands of meters under the ground. Geothermal production wells also require rotary or rotary-percussion drilling and require the existence of an injection well and an extraction well. The exploration efficiency also depends on the permeability of the soil, and that is why it has been developed the Enhanced Geothermal Systems (EGS). Throughout this review study, it can be verified that the analysis of the extraction processes of energy resources is essential since these resources are responsible for society development. Furthermore, the comparative analysis of costs and well drilling techniques for water, geothermal energy, oil, and gas production, which is the main goal of this research, can enable the growth of energy generation field through the emergence of ideas that improve the efficiency of energy generation processes.

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