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GEOTHERMAL ENERGY USAGE IN HYDROGEN PRODUCTION

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Hydrogen is an energy carrier, and subject of a lot of research work and some consider it as the energy of the future. Hydrogen provides the connecting point between renewable electricity production and transportation, stationary and portable energy needs. When the electricity from solar photovoltaic, wind, geothermal, ocean and hydro technologies is used to produce and store hydrogen, the renewable source becomes more valuable and can meet a variety of needs. In transportation applications, hydrogen provides a way to convert renewable resources to fuel for vehicles. If hydrogen is to become the energy of the future, it must be produced using renewable energy sources and the technical, economic problems on its production, storage, transportation, and use should be solved. There are various methods used in hydrogen production. Some of these methods include steam methane reforming, electrolysis, coal gasification, liquid reforming, high-temperature electrolysis, high-temperature thermo-chemical water-splitting, photo-biological, and photo-electrochemical. The first three methods are currently used while the remaining ones are still being researched or developed. These methods may require electricity and/or heat inputs. Geothermal energy provides an affordable, clean method of generating electricity and providing thermal energy. In this regard, the use of geothermal energy for hydrogen production can prove to be effective option in the future hydrogen structure. We have developed six models for using geothermal energy for hydrogen production. The models are studied thermodynamically in order to assess their performance for maximizing hydrogen production rate while minimizing the used geothermal energy. The effect of geothermal water temperature on various thermodynamic performances of the models is investigated. The models include using geothermal work output as the work input for an electrolysis process (Model 1); using part of geothermal heat to produce work for electrolysis process and part of geothermal heat in an electrolysis process to preheat the electrolysis water (Model 2); using geothermal heat in an absorption refrigeration process to precool the gas before the gas is liquefied in a liquefaction cycle (Model 3); using part of the geothermal heat for absorption refrigeration to precool the hydrogen gas and part of the geothermal heat to produce work with a binary geothermal cycle and use it in a liquefaction cycle (Model 4); using geothermal work output as the electricity input for a liquefaction cycle (Model 5); and using part of geothermal work for electrolysis and the remaining part for liquefaction (Model 6).

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