Investment in common-use network infrastructure to trigger incremental expansion in geothermal energy generating capital stock

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This paper analyses the potential of a novel approach to avoid the cost of expensive transmission infrastructure in connecting remote geothermal power suppliers to market through a community of data centres. A strategy for investment in a common-use facility to trigger incremental growth in a complementary commercial alliance is presented. The commercial alliance consists of investors in the 'common-use' fibre-optic cable data network, a community of data centres, and geothermal energy resources.

A real options approach to capital investment decision making is used to define the conditions under which investment in the common-use facility (which in economics is a 'local public good'), will be commercially justifiable. Excess capacity in the fibre-optic network resource is what gives it the attributes of a 'local public good'. A critical assessment shows that investment in such infrastructure could play a significant role in triggering the initial and later additions to installed geothermal energy capital stock, to generate and supply power to a network of data centres in a remote area. The infrastructure needs of data centres are chosen for this assessment because these facilities can be collocated with the geothermal resource, and their energy consumption is well suited to a demonstration-scale plant.

The real options analysis of resource allocation in this hypothetical commercial setting is underpinned by the stochastic representation of the future growth in demand for energy from a network of data centres, in the micro-grid community described. The results from this analysis provide an understanding of the critical conditions under which investment in the fibre optic network resource could take place.

The real options approach is an appropriate tool to assess investment strategy in this context, because it incorporates uncertainty in consumer demand, and analyses the resultant flexibility in the timing of investment decisions. In contrast, the discounted cash flow method suggests that an investment decision is made only once, i.e. at the commencement of the discounting period.

Once a commercially justifiable investment pathway for the local public good is defined, a profile of incremental expansion in the installed geothermal energy production capacity can be derived. This derivation provides an optimised time series profile of incremental expansion in capital stock, to satisfy the discrete units of stochastic demand for energy in this micro-grid setting. The benefits of this assessment thus lie in the ability to understand the likely time period over which significant economies of scale in generating capacity can be achieved. This henceforth enables a characterisation of the point at which investment in electricity grid infrastructure (or the like) may be justified. The process associated with this stochastic approach to analysing investment decisions enables the consideration of the systematic risks in this much larger but end-goal investment horizon.

Finally the study presents public policy recommendations regarding State involvement in establishing capacity in this network resource, to assist the development of the necessary economies of scale in geothermal energy production over time.

Keywords: Real options theory, network infrastructure, local public good, geothermal energy.

Reference

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