Variability and Uncertainty in the Cost of Saline Formation Storage

Sean T. McCoy, Edward S. Rubin

Department of Engineering and Public Policy, Carnegie Mellon University, Pittsburgh, PA 15213, United States

Abstract

Cost estimates for CO₂ capture and storage (CCS) systems typically focus on details of the CO₂ capture process and make simplistic assumptions about the cost per ton of CO₂ for the transport and storage components of the system. These ad hoc assumptions ignore the large variability in the storage cost from site-to-site caused by variation in storage reservoir characteristics. Moreover, the typical costs of storage that are widely applied in CCS cost estimates do not fully consider the cost of site characterization and operational monitoring. To address this problem, we have recently developed an engineering-economic model for geological storage in deep saline formations. In this paper we briefly describe the newly-developed performance and cost models for CO₂ storage in deep saline formations, and use these models to develop a range of cost for CO₂ storage. The range of cost is explored using four cases, representing different types of potential storage reservoirs. Results from the four case studies show considerably different capital costs and, consequently, levelized costs of CO₂ stored. In addition, the sensitivity of CO₂ storage cost to variability and uncertainty in model input parameters for one of the case studies is examined. These results show clearly that the cost of CO₂ storage in saline formations is most sensitive to factors affecting site characterization costs, which have been significantly underestimated in most past studies, and are highly dependent on future regulation of geological storage projects.

© 2009 Elsevier Ltd. Open access under CC BY-NC-ND license.

Keywords: carbon capture and storage; geologic sequestration; carbon dioxide; storage economics.

1. Introduction

There are numerous options for geologic sequestration of carbon dioxide (CO₂) [1] and, while there is considerable uncertainty over the total capacity available for sequestration [2], it is clear that saline aquifers offer the largest potential for long term storage. While there are many analogues to CO₂ storage, such as acid gas injection [3, 4], natural gas storage [5, 6], disposal of treated wastewater [6, 7], and disposal of hazardous waste [6], there are still many gaps in our understanding of CO₂ storage processes, including the cost of storage [1].

The objective of this paper is to present the development of a model that will allow the cost of CO₂ storage to be estimated given the specifics of a storage site. The cost estimates for CO₂ storage are embodied in an engineering-economic model that is used to assess the sensitivity of storage cost to changes in geological settings and other...