Techno-economic evaluation of a coalbed methane (CBM) gas separation system using a multistage membrane technology

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The purpose of this paper is to identify the optimal configuration for the membrane-based gas separation system for CO2 separation from a raw coalbed methane (CBM) gas. To achieve this goal, we developed an optimization model to design multistage membrane separation systems by minimizing the total process cost, which includes capital costs as well as operating costs, under specified technical constraints such as purity and recovery rate. The proposed model is formulated using nonlinear programming (NLP) technique and implemented in GAMS environment with Baron Solver. Using the proposed model, we determined the optimal process configuration, including specific membrane area and the required separation stages to meet design specifications, and optimal operation strategies such as utility consumption operating pressure and temperature. We also analyzed major cost drivers of the underlying systems, which have an effect to system configuration and economics.