Abstract

An investigation involving three different project design parameters that are stimulated reservoir volume (SRV) fracture permeability, SRV fracture porosity, and SRV fracture spacing were carried out using in-house PSU-SHALECOMP model, which is a compositional dual porosity, dual-permeability, multiphase reservoir simulator. The simulator treats the shale gas formation as a dual-porosity, dual-permeability system with micropore and macropore structures representing the shale matrix and natural fracture network, respectively. Furthermore, the model is capable of investigating the effects of water present in the micropore structure as well as the effects of matrix shrinkage and swelling as a consequence of the carbon dioxide injection and production operations. In the numerical experiments considered, primarily rock and fluid properties and reservoir conditions representative of a Marcellus shale scenario were utilized as the basis to examine potential production rates of methane and cumulative methane production capacities. Horizontal well configurations together with the implementation of a computationally inexpensive SRV model with the ability to generate similar behavior to that of an equivalent discrete fracture network model have been instrumental in the analysis. It is observed that it is essential to obtain higher fracture permeabilities within the SRV zone to be able to effectively produce methane during the depletion period and to inject carbon dioxide. In the investigation of the SRV fracture porosity, it is shown that SRV fracture porosity values have a pronounced effect on bottomhole pressure, which may lead to longer injection periods.

References Cited


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An investigation reaching three different project design parameters that are stimulated reservoir volume (SRV) fracture permeability, SRV fracture porosity, and SRV fracture spacing were carried out using in-house PSU-SHALECOMP model, which is a compositional dual porosity, dual permeability, multiphase reservoir simulator. The simulator treats the shale gas formation as a dual porosity, dual permeability system with micro-scale and macro-scale structures representing the shale matrix and natural fracture network, respectively. Furthermore, the model is capable of investigating the effects of water present in the micro-scale structure as well as the effects of matrix shrinkage and swelling as a consequence of the carbon dioxide injection and production operations. In the numerical experiments considered primarily rock and fluid properties and reservoir conditions representation of a Marcellus shale scenario were utilized as a basis to examine potential production rates of methane and cumulative methane production. Numerical well configurations with horizontal well configurations together with the implementation of a computationally expensive SRV model with the ability to generate similar behavior to that of an equivalent discrete fracture network similarly have been instrumental in the analysis. It is observed that it is essential to obtain higher fracture permeabilities within the SRV zone to be able to effectively produce methane during the depletion period and to inject carbon dioxide. In the investigation of the SRV fracture porosity, it is shown that SRV fracture porosity values have a pronounced effect on bottomhole pressure, which may lead to longer injection periods.

Methodology

In this study, production rates on 30 years period consist in a specified fraction, which is 0.3 MMSCFD. Bottomhole pressures are compared after 30 years of simulation for several fractured SRV cases and in undepleted shale gas reservoirs with the ability to generate similar behavior to that of an equivalent discrete fracture network model. In this study, production rates on 30 years period consist in a specified fraction, which is 0.3 MMSCFD. Bottomhole pressures are compared after 30 years of simulation for several fractured SRV cases and in undepleted shale gas reservoirs.

Results

Trapped CO2 is immobile and becomes immobile underneath a thick seal in a conventional reservoir, which is also observed in a stimulated reservoir volume (SRV) fracture permeability, SRV fracture porosity, and SRV fracture spacing were carried out using in-house PSU-SHALECOMP model, which is a compositional dual porosity, dual permeability, multiphase reservoir simulator. The simulator treats the shale gas formation as a dual porosity, dual permeability system with micro-scale and macro-scale structures representing the shale matrix and natural fracture network, respectively. Furthermore, the model is capable of investigating the effects of water present in the micro-scale structure as well as the effects of matrix shrinkage and swelling as a consequence of the carbon dioxide injection and production operations. In the numerical experiments considered primarily rock and fluid properties and reservoir conditions representation of a Marcellus shale scenario were utilized as a basis to examine potential production rates of methane and cumulative methane production. Numerical well configurations with horizontal well configurations together with the implementation of a computationally expensive SRV model with the ability to generate similar behavior to that of an equivalent discrete fracture network similarly have been instrumental in the analysis. It is observed that it is essential to obtain higher fracture permeabilities within the SRV zone to be able to effectively produce methane during the depletion period and to inject carbon dioxide. In the investigation of the SRV fracture porosity, it is shown that SRV fracture porosity values have a pronounced effect on bottomhole pressure, which may lead to longer injection periods.


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