Assessment and Sensitivity Considerations of a Potential Storage Site for Carbon Dioxide: A Queensland Case Study

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Australia's coal-fired power plants produce about 70% of the nation's total installed electricity generation capacity and emit about 190 million tonnes of CO_2/year, of which about 44 million tonnes come from central and southeast Queensland. A multi-disciplinary study has identified the onshore Bowen Basin as having potential for geological storage of CO_2. Storage potential has been documented within a 295 km2 area on the eastern flank of the Wunger Ridge using a simplified regional 3-D model, and is based on estimating injection rates of 1.2 million tonnes CO_2/year for 25 years. Paleogeographic interpretations of the Showgrounds Sandstone reservoir in the targeted injection area indicate a dominantly meandering channel system that grades downdip into a deltaic system. Seismic interpretation indicates a relatively unfaulted seal and reservoir section. The depth to the reservoir extends to 2700 m.

CO_2 injection simulations indicate that at least one horizontal or two vertical wells would be required to inject at the proposed rate into homogeneous reservoirs with a thickness of approximately 5 m and permeability of 1 darcy. The existence of intra-reservoir shale baffles necessitates additional wells to maintain the necessary injection rate: this is also true for medium-permeability reservoirs. The long-term storage of the injected CO_2 involves either stratigraphic and residual gas trapping along a 10 to 15 km migration path, and ultimately, potentially, within updip depleted hydrocarbon fields; or trapping in medium-permeability rocks. Trapping success will be a function of optimal reservoir characteristics including specific permeability ranges and the distribution of seals and baffles. Sensitivity analysis of CO_2 injectivity indicates that dissolution effects may increase injection rates by up to 20 %.