13.4 **A low CO_2 hybrid in-situ oil shale liquid production process**

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In-situ methods for producing oil from oil shale have certain advantages over mining and surface processing. Land surface disturbance is minimal, mining operations are avoided, and deep or other resources inaccessible to mining can potentially be exploited more efficiently. In-situ thermal processing technologies have advanced greatly in recent years, and include cyclic steam injection, SAGD, in-situ combustion, underground gasification, in-situ pyrolysis, and so on. Each technology has advantages and disadvantages depending on the specific economic, environmental, geological, and physical characteristics of the resource. Often it is beneficial to combine different processes to improve efficiency and recovery. The pyrolysis process in which kerogen is converted to oil, gas and coke is energy intensive. It is shown that the energy requirement can be reduced significantly by in-situ coke combustion. In this study, STARS (steam, thermal and advanced processes), a reservoir simulator by CMG, was used to examine an in-situ oil shale production strategy including pyrolysis followed by in-situ coke combustion. The total energy reduction is dependent on the time at which the combustion operations are begun relative to the start of the pyrolysis process. Carbon dioxide emissions for oil shale processing technologies will also be a concern as eminent constraints add risks to potential opportunities. The potential for carbon dioxide recycling and storage back into the reservoir was also explored and it is shown that carbon dioxide produced during the process can be used first for flushing additional oil out of the reservoir after which some portion of that carbon dioxide can be sequestered.