Challenges and solutions for shale oil upgrading

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The nature of raw shale oil presents some significant challenges which must be addressed before finding a workable solution for upgrading shale oil into finished transportation fuels. Some of the key challenges involve high concentrations of hetero compounds, unsaturates, and arsenic, as well as issues with particulates, and potential plugging problems due to oxygen exposure during extraction. We have significant experience in development and operation of shale oil upgrading technology, dating back to the operation of a commercial plant in Colorado. Since then, we have continued development aimed at further improvements to product upgrading technology, resulting in enhanced understanding of the removal of contaminants such as arsenic and particulates, and advanced hydroprocessing configurations to produce high-quality ultra-low-sulfur distillates and gasoline. This paper will provide an overview of the Colorado operation, a summary of key lessons learned from that experience, and fast forward to development work conducted recently to support proposed commercial shale oil operations. In addition, an interesting application of this technology for upgrading of raw shale oil to high-quality fuels in a future commercial plant will be discussed. The characteristics of this European shale oil and the project's production goals provided some interesting challenges for the development of process configurations for this project. The combination of our experience base and new technology development has resulted in an effective and robust solution.