

## **Manage Wettability and Oil Recovery with Salinity Control**

**Geoffrey D. Thyne<sup>1</sup>**

<sup>1</sup>ESal

### **Abstract**

The industry faces increasing costs for new oil resources' discovery and development. The long-term outcome is an increase in price to match cost, but it is unclear if oil prices can increase sufficiently to offset costs unless demand remains strong. One approach to maintaining profitability is improved recovery in both new and older fields. We report on an economical approach to increase oil recovery by manipulating inorganic water chemistry. The investigation of the potential benefits combines laboratory measurement of wettability and determination of wettability sensitivity to salinity and chemical composition with field applications and economic modeling. The laboratory procedures focus on the modified flotation technique to provide fast, accurate and inexpensive evaluations of reservoir wettability. These results are coupled to field cases that compare predicted outcomes with production data. Economic models, informed by operational costs, enable robust analysis of costs and benefits and establish the basis for decision making. Changing the inorganic water chemistry of injected fluids for conventional and unconventional reservoirs has little or no CAPEX and low OPEX. This approach can offer an attractive alternative to the traditional E&P approach and the associated risks. Examples from North American and North Sea fields demonstrate that the ROI, NPV and payback periods for these projects provided significant upsides. The outcomes include lowering decline rates, extending field life and improving EUR. The data show these projects deserve consideration depending on specific asset characteristics and corporate portfolios. The examples also provide screening criteria that enable rapid and accurate prediction of which fields are most inclined to this approach. Finally, some examples show that care must be used since this approach can produce wettability damage increasing decline rate and shortening field life and lowering value. Negative outcomes can be avoided by pre-deployment testing and may offer remedies for reservoirs already impacted by wettability damage. Using water chemistry to increase recovery offers another tool for scientists and engineers working in oil fields. The information provided will educate geologists and engineers about the potential benefits and pitfalls of applying this technique. This is science beyond the textbook based on the latest theory, practical methodologies and field experiences.