

What is unique about OLI technology

OLI is uniquely able to provide a thermodynamic model that can be used to predict all phases encountered in production - gas, oil, solids, and brine. OLI has already conquered the complexity of brines and its interaction with hydrocarbons and solids. OLI's robust framework and expandable engine will now allow you to streamline your model development and eliminate deviations among the various modeling tools that you use for the differing development and production needs.

A unified framework

We suggest a unified OLI solution for all your electrolyte design and production work - to be the primary/only property package used in every software tool for any type of aqueous chemistry situation. This will result in greater consistency across the various technology teams, and represent the single source of thermodynamics that, when necessary, can be modified as needed. This is what will be possible when working with an expandable framework that could be expanded through project work to even include your own nonelectrolyte (hydrocarbon) equation of state if desirable.

The cornerstone of upstream modeling

The Mixed-Solvent-Electrolyte (MSE) thermodynamic electrolyte model for all water-solid interactions is the foundation model. You can then use the pioneering new MSE-SRK framework that has been optimized for pure component hydrocarbons and inorganic gases. With development work, you can add new chemicals like scale inhibitors, demulsifiers, polymers, and other materials important to continuous operations. There is also the framework that with development can be extended to your own mechanisms for fluid-rock interactions, including ion exchange on shale minerals, inhibitor adsorption onto rock minerals, and / or scale kinetics.

Thus, a single, unified mathematical model can be used for all processes, whether it is production from shale, oil sands, or conventional reservoirs.

Selected processes that benefit from this unified framework

Production and flow assurance

What you can accomplish

- Multiphase fluid properties during production operations ✓
- Scale formation from the reservoir through the flowline
- General and localized corrosion in production equipment ✓
- Gas condensation corrosion ✓
- Annular fluid properties and its reactivity with infiltrating fluids and gases ✓
- Hydrocarbon production and phase envelope
- Autoclave charging and corrosion testing with fugacities or partial pressures ✓

✓ *OLI unique features that no other simulator or property package can provide!*

Without OLI technology, your ability to:

- Develop precise autoclave experiments would be lost.
This would lead to increased material costs (over-conservative estimates) or increased corrosion risk (incorrect experiment).

think simulation | getting the chemistry right

- Predict mass transfer in low water-cut wells would be lost.
This would lead to unnecessary CAPEX (design for salt problems that do not exist) or lost production (unexpected tubing plugging)
- Predict injection fluid breakthrough composition and compatibility would be diminished.
This would lead to increased OPEX (additional squeeze treatments) and lost production

Enhanced recovery

What you can accomplish

- Fracking fluids properties and their reactivity with shale rock/minerals ✓
- Injection water reactivity with the rock as it transports through the formation ✓
- Acid stimulation and the rate limiting reactions with carbonates and aluminosilicates
- EOR (CO₂, N₂, steam) injection and reactivity with the formation

✓ *OLI unique features that no other simulator or property package can provide!*

Without OLI technology, your ability to:

- Develop programs to create predictive frac flowback water would be diminished.
This would lead to increased OPEX (unexpected squeeze treatments) and loss of production (well downtime)
- Predict effects of stimulation fluid on rock would be diminished.
This would lead to increase chemical costs, suboptimal production rates, or increased risk of formation damage.

Surface operations

What you can accomplish

- Seawater desulfurization
- Sag-D produced water treatment up to and including complete plant simulations ✓
- Boiler Feed Water (BFW) purification
- Produced water treatment and disposal ✓
- Gas sweetening, dehydration and other treatments
- Amine unit's performance and efficiency
- Carbon capture, transport, and sequestration including deep well injection and reactivity with formation ✓

✓ *OLI unique features that no other simulator or property package can provide!*

Without OLI technology, your ability to:

- Develop programs to create predictive frac flowback water would be diminished.
This would lead to increased OPEX (unexpected squeeze treatments) and loss of production (well downtime)
- Design and engineer CCS programs would be handicapped.
Only OLI has the technology to predict accurately, the chemistry of capture, transport, and underground storage.



- Model water and treatment processes would be limited to using estimates or tuned models. This means empirical designs with limited extrapolation range and increased engineering design costs.

A single, consistent set of thermodynamic models creates a seamless relationship between design and operations and across all areas of expertise within your company. This is because the key chemical mechanisms of production are either available in the existing tool or can be added to the current framework.

Selected key chemical mechanisms ✓

Now available or will become available through OLI research or through past sponsored research projects

- High T (300 C), High P (2500 bar) phase predictions
- Corrosion prediction in HTHP production environments: general and localized corrosion and stress corrosion cracking ✓
- H₂S/CO₂ fugacity and brine solubility and their impact on corrosivity ✓
- Silicate chemistry (steam injection and BFW treatment) ✓
- Corrosion kinetics (present) ✓ and inhibition (planned)
- Scale kinetics (present) and inhibition (in process)
- Salt solubility in methanol and glycol solutions ✓
- Exotic scales and other shale-derived minerals ✓
- H₂S scavenger chemicals
- Framework for polymers, crosslinking agents and other viscosity modifiers
- Hazardous components: mercury, arsine, hydrogen selenide ✓
- Chemistry of completion fluids

✓ *OLI value-added and differentiated chemistries*

Professional services

- Access to experienced upstream consultants (*with Silver, Gold, Platinum service*)*ag*
- Access to corrosion engineers and scientists in order to extend the corrosion model
- Access to thermophysical modelers to extend the chemistry into other scavengers, polymers, etc.
- All levels of standardized and customized training onsite or via web
- Expert setup and interpretation services
- Best practices advice based on process simulation and design experience with commercial clients

... Where would you be without OLI technology?

- Higher experimental costs
- Lower research productivity
- Higher risk of catastrophic failure due to scaling, corrosion
- Increased risk of making poor engineering decisions
- Lower engineering productivity due to inconsistent models
- Lack of insight to chemical processes
- Increased gap in knowledge in how to address water chemistry challenge

