Challenges of Scale in Geothermal Systems & The Importance of Accurate Fluid Modeling

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CHEMISTRY MATTERS | ACCELERATING SUSTAINABILITY

The Problem

- Scale forms when dissolved ions in geothermal fluids exceed solubility limits.
- Common scales: Calcite ($CaCO_3$), Barite ($BaSO_4$), Silicates (e.g. SiO_2) and Sulfides (e.g. PbS)
- Scale causes pipe clogging, reduced heat exchanger efficiency, and lower well injectivity to name a few
- Scale formation is driven by:
  - ✓ Incompatibility (mixing of incompatible fluids)
  - ✓ Self-scaling (temperature and pressure changes)
  - ✓ Fluid/mineral interaction and equilibration

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The Complexity of Scale Formation

Scale formation is driven by:

- Species partitioning between phases
- Components dissociation in water
- Solubility products
- Kinetics effects
- Trace element effects (Fe, Al, Ca, etc.)

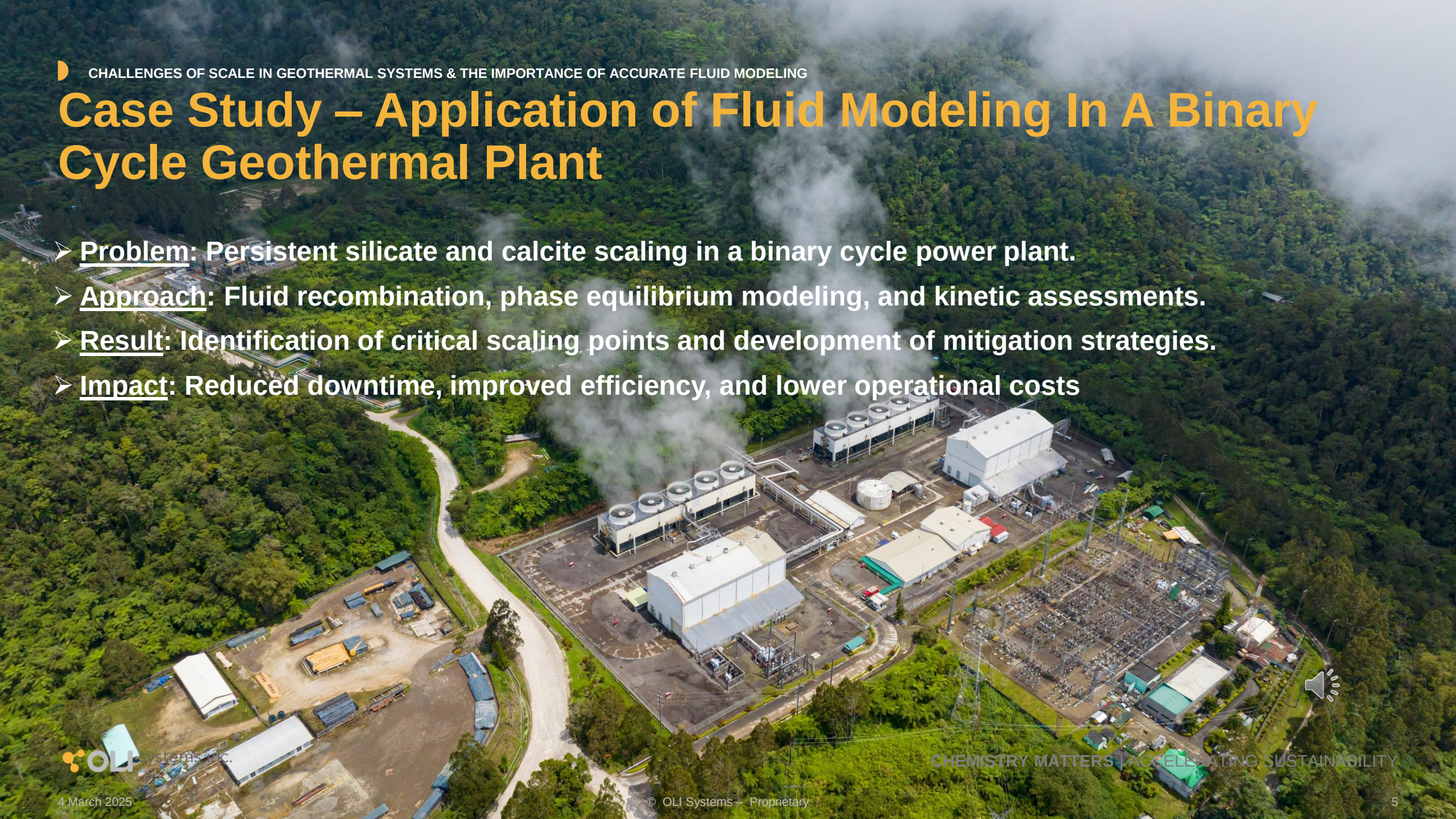
Kinetics & thermodynamics to capture real-world conditions.

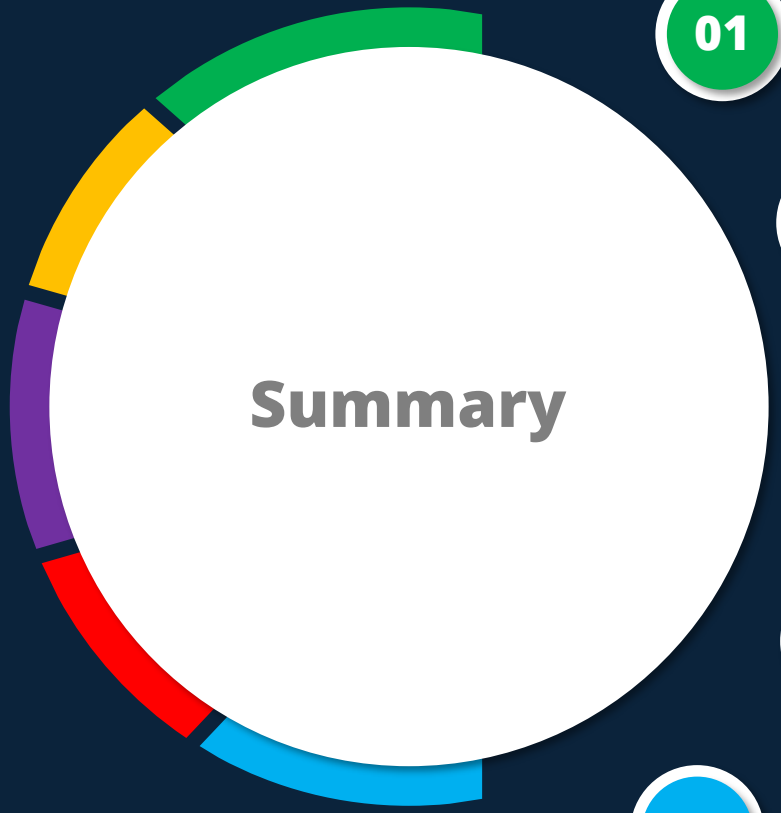
The Role of Accurate Fluid Modeling & Strong Database

- 4 –Phase Mass Balance
- Advanced Thermodynamics
- Strong Database
- Real World Applications
  OLI Studio ScaleChem

Case Study – Application of Fluid Modeling In A Binary Cycle Geothermal Plant

- **Problem**: Persistent silicate and calcite scaling in a binary cycle power plant.
- **Approach**: Fluid recombination, phase equilibrium modeling, and kinetic assessments.
- **Result**: Identification of critical scaling points and development of mitigation strategies.
- **Impact**: Reduced downtime, improved efficiency, and lower operational costs





01

INORGANIC SCALE

The formation of inorganic scale represent a major challenge in geothermal systems.

02

FLUID MODELING

Accurate fluid modeling is essential to correctly predict the scale risk in a geothermal plant

03

THERMODYNAMICS AND KINETICS

Thermodynamic and kinetic models must capture interconnected reactions to provide reliable results.

04

DATABASE

A strong database ensures accurate, real-world predictions.

05

OLI SYSTEMS

Software tools like OLI Studio: ScaleChem can help optimize geothermal system performance.

Thank you!

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