Current bitumen extraction process from the Alberta oil sands is plagued by high fresh water use (4-5 bbl of fresh water per bbl of oil), high energy consumption (i.e., high GHG emission of 88 kg CO₂ per bbl of oil), and large tailings impoundment areas (>170 km² so far). All three problems are caused by the mobilization of the fine minerals (clays) in the oil sands by the caustic warm water, which combine with un-extracted residual bitumen to form a gel-structure that holds water indefinitely.

UAlberta has been working with Imperial Oil in the past 10 years to develop non-aqueous extraction (NAE) processes through the Institute for Oil Sands Innovation (IOSI). The NAE can operate at ambient temperature and generate dry stackable tailings, thus eliminate all the three problems above. Our vision of how the oil sands, as an energy source, fits in an energy system in the near future is as follows:

**Short-term objectives**

The short-term objective of this project (next 2-4 years) is to identify techniques that can remove the fine mineral solids from bitumen-solvent product to below 0.03 wt% through small-scale laboratory testing. Techniques that will be tested include: removal by bio-inspired polymers; by seasoned water droplets; by functionalized magnetic particles; by mild hydrothermal treatment and hot filtration. The possibility of combining bitumen cleaning with partial upgrading of the bitumen in the hydrothermal process will be explored. First, by using the clays as reactive surfaces, drawing on the catalytic properties inherent to the clays to change both clay and bitumen. Second, by understanding how non-aqueous extraction can best promote partial upgrading in tandem with extraction.

Ultimately, the identified technique(s) in an integrated NAE extraction and bitumen product cleaning circuit to assess the viability of the technique(s), and to deal with the separated fine solids streams. It is also anticipated that the product cleaning and partial upgrading can be accomplished in a single step if a mild hydrothermal treatment is used.