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## Examining the Role of Emerging Oil Sands Technologies in Reducing Greenhouse Gas Emissions Using Experts' Assessments

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### Abstract

Emerging oil sands technologies could influence industry-wide greenhouse gas emissions, however projecting future emissions is difficult due to limited public reporting of expected performance and deployment of emerging technologies. An expert elicitation was conducted to gauge how experts anticipate emerging in situ, surface mining and upgrading technologies will be deployed and perform compared to current technologies. All experts project the majority (60-98%) of in situ bitumen production in 2034 will be produced using current technologies or hybrid steam-solvent processes. Experts built boxplots to show how they project commercial projects employing emerging technologies would perform in 2034 compared to a current project employing steam-assisted gravity drainage. Across experts, the median reduction in steam-to-oil ratio for hybrid steam-solvent projects and current in situ projects employing process changes (e.g., better well placement) ranged from 3-30% and from 12-14%, respectively. Median projections from experts about the change in bitumen recovery rate compared to a current (2014) steam-assisted gravity drainage project ranged from 3-30% for hybrid steam-solvents and up to 15% for electro-thermal and in situ combustion projects. The responses show that a slight reduction in energy consumption is expected by experts from the adoption of hybrid steam-solvent processes. Experts projected that emerging in situ technologies, which have the largest potential for adoption, will be used primarily for accessing marginal resources and increasing overall production levels, rather than targeting greenhouse gas emissions reductions. Therefore, deployment of emerging technologies is not expected to contribute substantially to meeting greenhouse gas emissions reduction targets for the industry by 2034 under the regulatory conditions at the time of the elicitation, a key insight for policy makers.

### Keywords

Expert elicitation; oil sands; energy consumption; emerging technologies; bitumen extraction

### 1. Introduction

The Canadian oil sands, with 166 billion barrels of remaining established reserves (AER 2015), are a vast oil resource whose extraction and processing have significant environmental and economic consequences (RSC 2010). Several oil sands technologies currently under development have the potential to influence industry-wide greenhouse gas (GHG) emissions. A limit on GHG emissions is anticipated (AB 2015) and the industry faces external pressures to limit or reduce its emissions. While experts within the industry possess knowledge about the potential performance and deployment of these emerging technologies, limited public information is available, which limits policymakers' ability to effectively target the deployment of technologies for reducing the GHG emissions intensity of bitumen production. To address this, an expert elicitation was carried out to obtain input from experts on how they predict emerging

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