INTERNATIONAL NUCLEAR ENERGY RESEARCH INITIATIVE

Upgrading of the Athabasca Oil Sands for the Production of Diesel and Gasoline

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Collaborator: Chalk River Laboratories

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Project Abstract

This project represents a three year collaboration between Idaho National Laboratory (INL) and Atomic Energy of Canada Limited (AECL) to develop a preliminary design for an integrated complex consisting of a nuclear reactor, electrolytic hydrogen plant and bitumen upgrader. The complex will provide steam for bitumen extraction and electricity for the electrolytic hydrogen plant. The hydrogen produced will be sent to the bitumen upgrader to produce synthetic crude oil, gasoline and diesel fuel. The integrated plant will be optimized to maximize thermal efficiency and minimize the use of water. This project builds on a previous I-NERI project that developed a preliminary design to integrate a nuclear reactor with a high temperature electrolysis system.

The project is composed of two main tasks. This first is to define the requirements that the integrated complex will meet. These requirements include determination of the temperature, pressure and quality of the steam required for the Steam Assisted Gravity Drainage (SAGD) process. Reference designs for the nuclear reactor, hydrogen production process and process for bitumen upgrading will also have to be selected. The bitumen upgrading process selected will specify the requirements for the hydrogen stream (temperature, pressure and quantity) produced by the electrolytic hydrogen plant.

The second task is to develop the integrated model of the complex consisting of a nuclear reactor, hydrogen plant and bitumen upgrader. The model will be developed using the process simulator HYSYS from AspenTech, Inc. HYSYS was originally designed as a process simulator for oil and gas applications, so it is suitable for the simulation of a bitumen upgrading process. HYSYS was used by INL staff for their work on integrating a nuclear reactor with a high-temperature electrolysis plant.