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Changing the World's Perspective on Heavy Oil*

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Abstract

The world's resources of heavy oil and bitumen are estimated to be over 8 Trillion barrels. The challenge of recovering these reserves with in situ combustion technology is discussed. Earlier attempts at in situ combustion have been unsuccessful until the THAITM method was proposed. This process has been successfully computer simulated and tested in the laboratory. These results indicate the robustness of the process that has lead to field testing at the Whitesands pilot in the Athabasca oil sands.

The process has many benefits over earlier thermal technologies. Recovery is greatly enhanced, partly since the combustion temperatures exceed 350° C. The product is upgraded in situ that yields a higher price at delivery or at the refinery. Costs are reduced when compared to thermal processes needing large steam generators and fuel to operate. This process eliminates a need for NG and water and can provide its own electrical power. The produced gas stream contains sufficient NG to operate air compressors and to generate electrical power. The reduced footprint allows this design to be placed remotely to access heavy oil that is presently economically stranded.

Projected gas purchased for in situ projects in Alberta is expected to be over 350 BCF by 2016. This may be better used to generate electricity and to heat our homes by using this process. Resource estimates for Alberta's oil sands are over 1.7 TBO. Currently a small portion is being mined, while the larger in situ portion is actively being produced using thermal steam technology.

The effectiveness of the popular SAGD and CSS processes is limited to the very thick pay on the eastern limits. These processes are challenged by pay thickness of less than 20m, and by reservoirs with shale laminae. However, these thinner reservoirs represent a very large part of the resource. The best technology will be needed to turn these resources into reserves.

New technology is the key to unlocking the world's enormous heavy oil resources. The THAITM technology is a step change in this direction.

**Changing the World's
Perspective on Heavy Oil
AAPG Conference
Calgary, AB
September 2010**

Presentation Outline

- Massive global potential
 - Comparing conventional and heavy oil resources
- Introduction to the THAI™ technology
 - From theory, to model, to field testing, and to commercial
- Benefits of a superior recovery process
- Guidelines
 - Where does THAI™ work best?

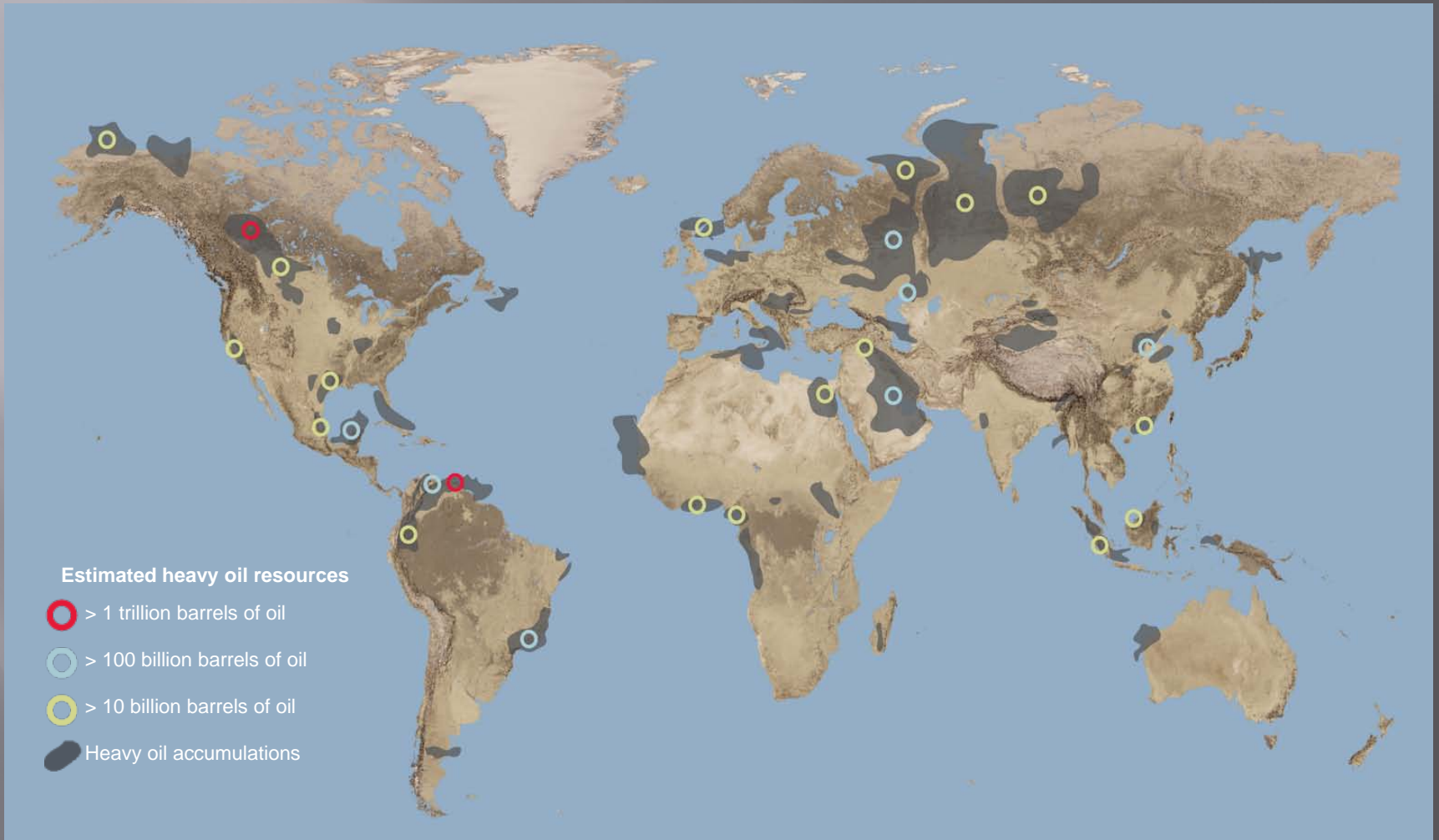
Changing the World's Perspective

- Heavy oil and bitumen enhanced recovery has required increased well density and large surface facilities as a consequence of viscosity
 - In situ combustion techniques have now evolved into a process that dramatically increases recovery while minimizing surface footprint

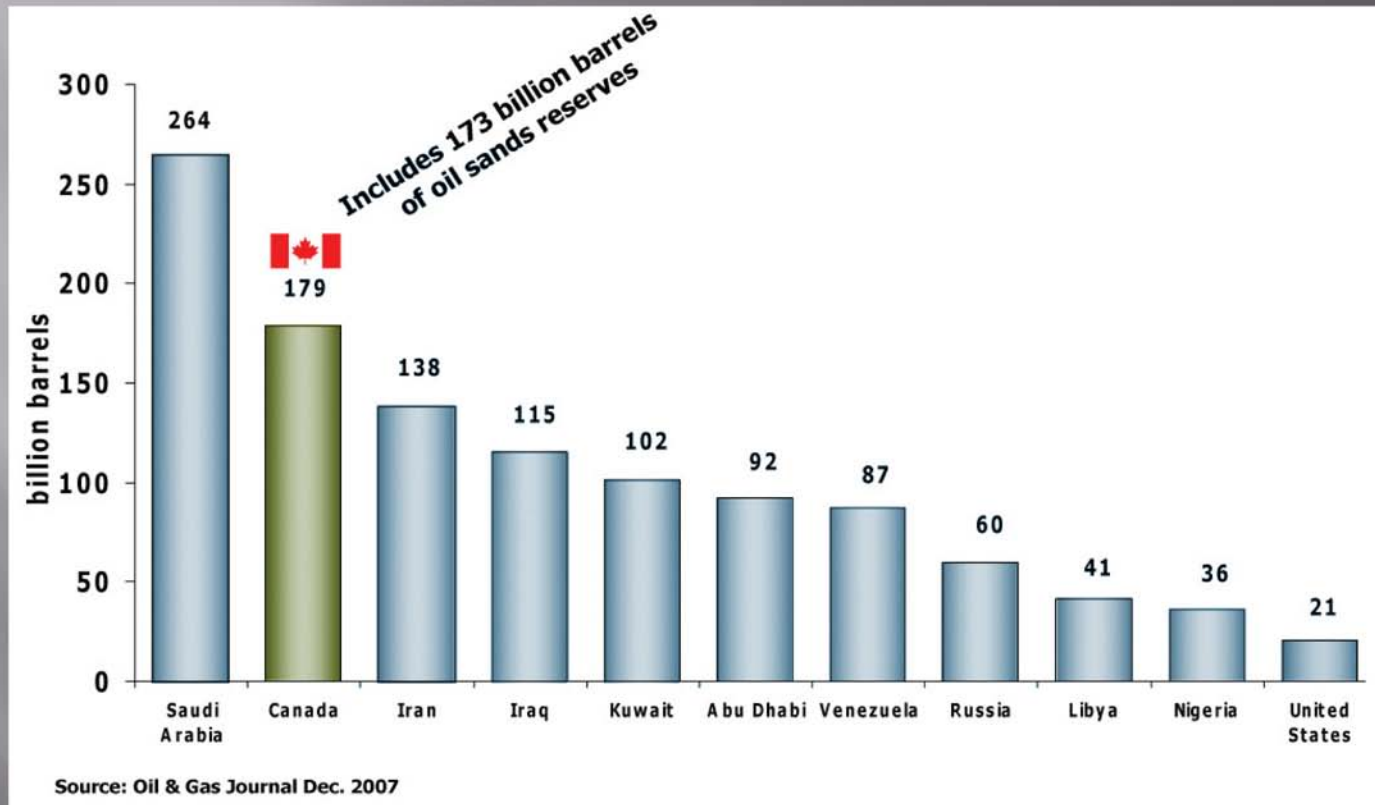
Conventional vs Heavy Oil

- **Conventional reserves**
 - Peak world production occurred in 2004
 - Remaining reserves are 1.32 TBO (BP and others)
 - New discoveries are not expected to impact decline.
- **Heavy Oil and Bitumen resources**
 - 9 TBO resources known throughout the world
- **The challenge is capturing these resources efficiently with a minimal environmental impact**
 - New technology is unlocking this potential

Global Heavy Oil Potential



Canada's Oil Reserves

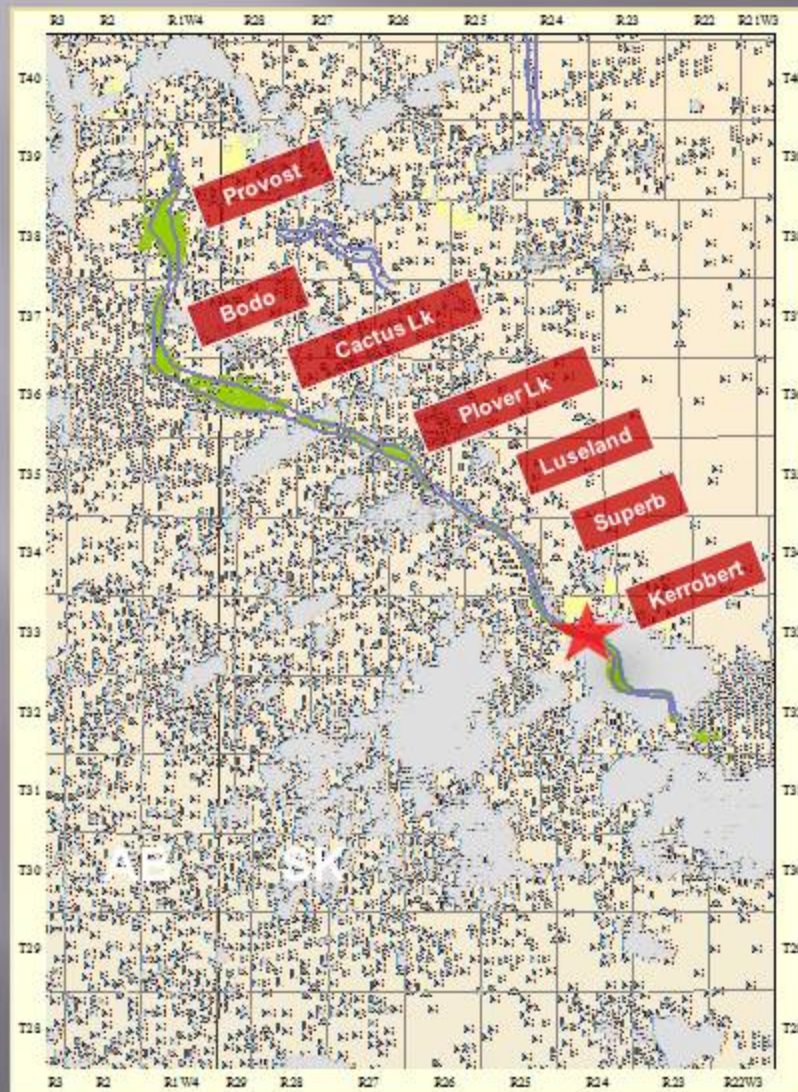


Notes by Presenter: A significant source of supply is Canada's oil reserves, which are #2 in the world, second behind Saudi Arabia. Without our oil sands, Canada would not even be on the energy map. In fact, 97 per cent of Canada's 173 billion barrels of oil reserves come from oil sands. As far as our oil output is concerned, oil sands account for over half.

Heavy Oil Opportunities



Kerrobert Heavy Oil Trend



The Kerrobert Project is the first THAI™ project in Saskatchewan

This Mannville Channel contains over 1.0 BBbls of original heavy oil

History of In Situ Combustion

- Earliest ISC pilots date back to the 1920's in USA, and were first successful in the 1950's in California
- Most of these attempts were not commercial and often had complications with extremely high temperatures at the production wells
- Recent ISC pilots include Battrum (Roseray) and Provost (Upper Mannville) and the commercial Suplacu de Barcau (Romania)

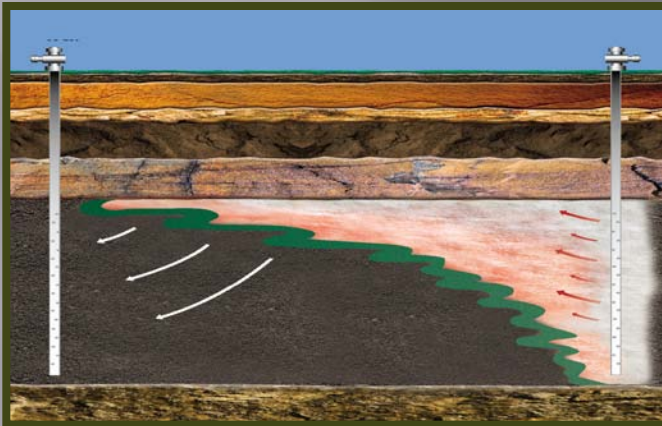
The THAI™ Process

- This new process was envisioned in the 1990's with the advent of horizontal wells
- It was jointly proposed by Dr. Conrad Ayasse, Dr. Malcolm Greaves and Dr. Alex Turta and later acquired by Petrobank in 2003 for pilot testing
- Computer modeling indicates the robustness of the process
- Lab simulation in a 3D combustion reactor is conducted with consistent results confirming the process

EVOLUTION OF IN SITU TECHNOLOGY

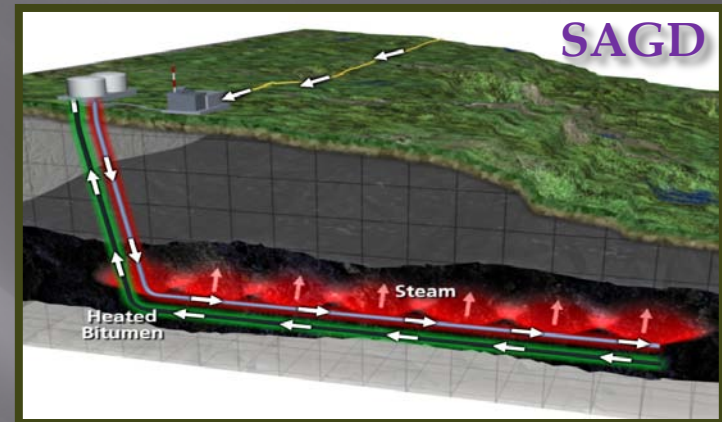
Vertical Wells
Long Distance

External
Heat
(Steam)

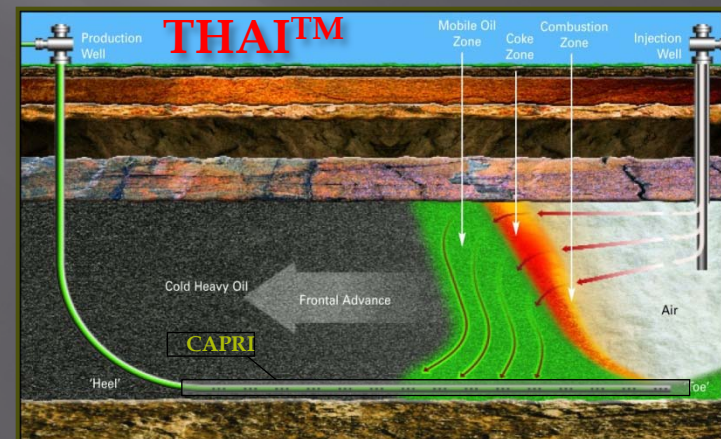
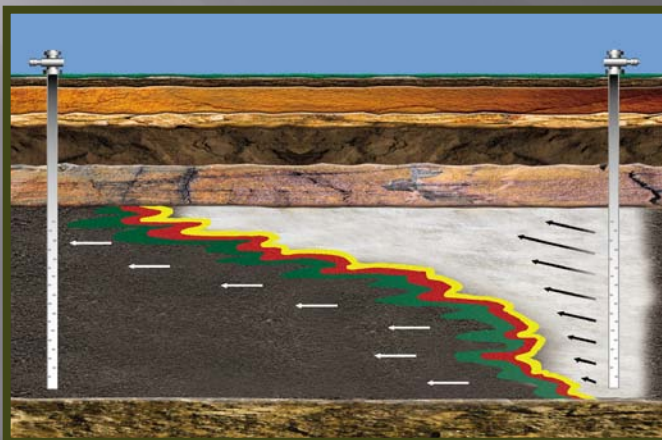


Horizontal Wells
Short Distance

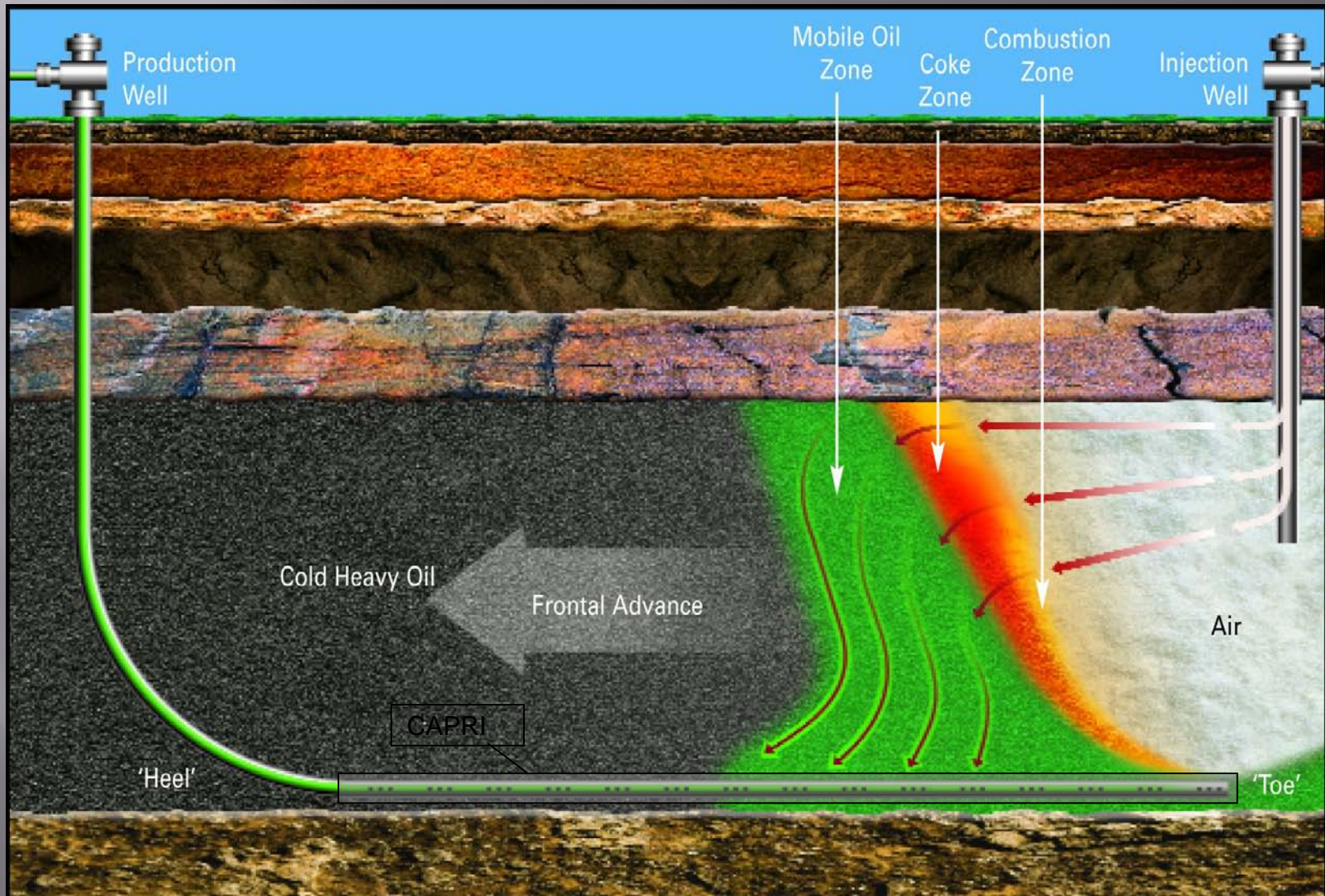
SAGD



In-Situ
Heat
(ISC)




Toe to Heel Air Injection



THAI™ Process

Click to View Movie

THAI™



THAI™ Benefits

- **Benefits of a superior recovery process**
 - High recovery
 - Minimal water useage
 - Minimal natural gas required
 - Cost effectiveness
 - Reduced emissions
 - Upgraded product
 - Self-supporting design
 - Minimized footprint
 - And CO₂ capture ready

Archon Technologies



- World's only 3-D combustion reactors
 - Ongoing combustion analysis of bitumen and heavy oil from around the world
 - Ability to evaluate various combustion scenarios to expand technology footprint



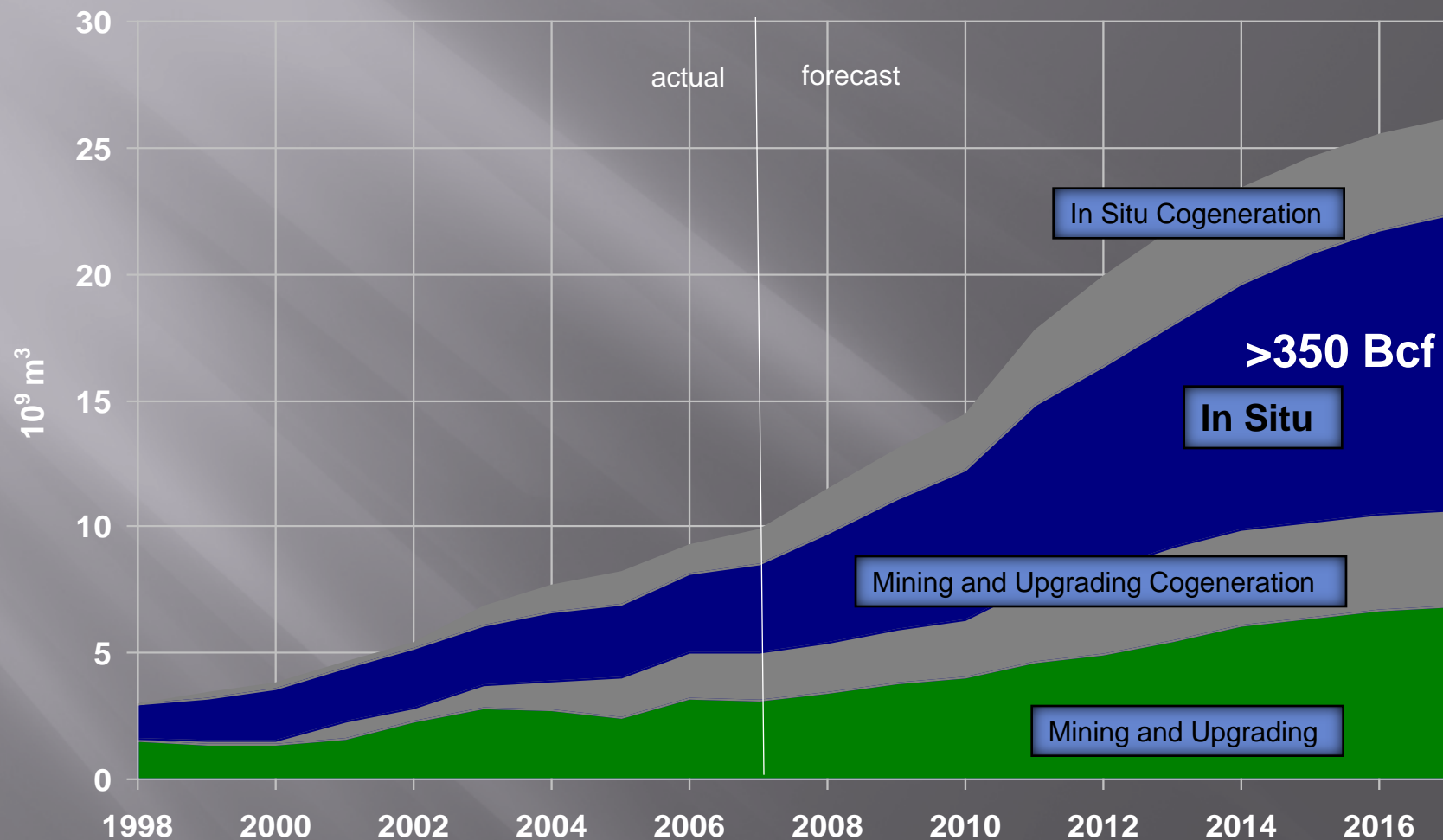
- Capable of conducting a wide variety of analysis to support field operations
 - Oil quality
 - Produced gas
 - Produced water
 - Solids

THAI™ Produced Water



- High quality produced water
- No difficult emulsions
- Easy oil/water separation
- Useable water product with minimal treatment
- No corrosive fluids

Purchased Gas Projection



Purchased natural gas demand for oil sands operations

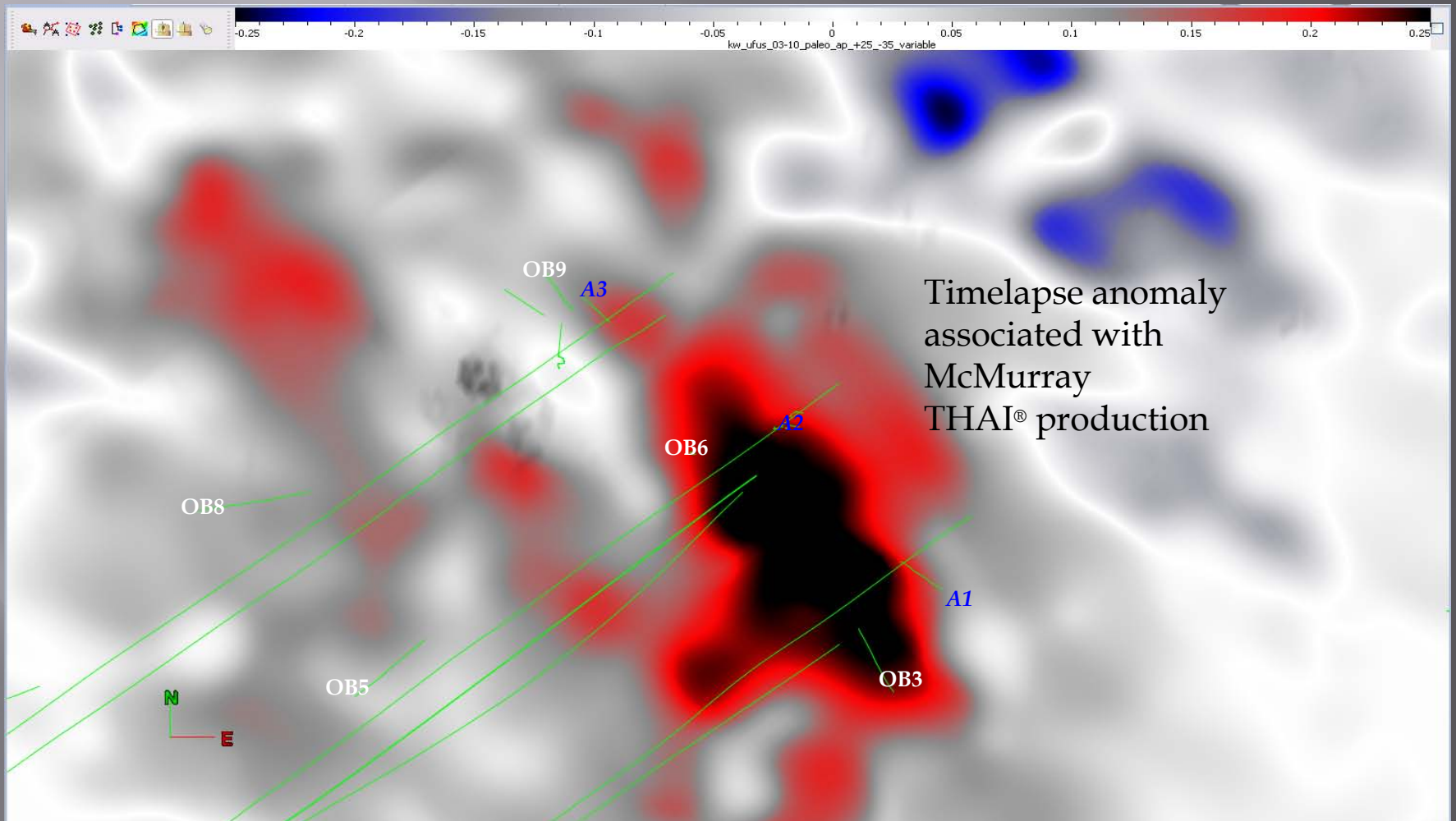
Source: ERCB ST98-2008

Whitesands THAI™ Pilot

Small Footprint



TIMELAPSE (4D) Seismic



THAI™ Upgrading



Native bitumen 8° API,
550,000 centipoise

In-situ upgraded THAI™ oil
12° API, 1,225 centipoise

Consistent THAI™
upgrading since start up
Confirmed CAPRI™ catalyst
upgrading
“CAPRI™ oil” quality up to
15° API



Produced condensate 36° API

THAI™ Upgraded Oil

Sales Oil Quality

	<u>Bitumen*</u>	<u>Partially Upgraded Production</u>
Viscosity at 20°C, centipoise	555,000	1,550
Oil Sulfur content, wt %	3.2	2.6
API Gravity	7.9	12.3

“SARA” ANALYSIS

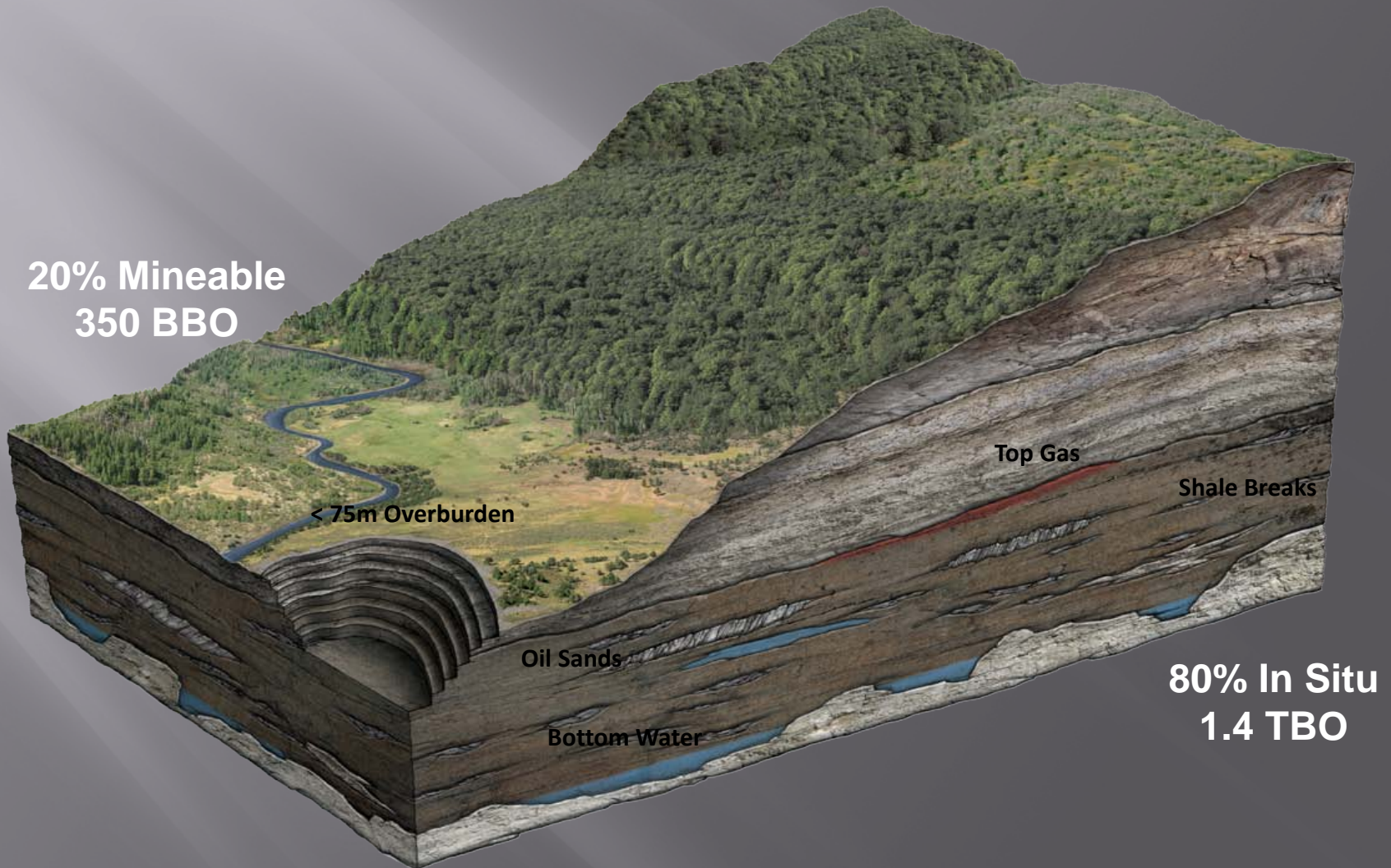
Volatile organics, 40°C mass %	21.1	25.5
Saturates	12.7	23.5
Aromatics	30.3	22.6
Resins	19.0	17.2
Asphaltenes	16.9	11.2

*revised analysis

Reservoir Guidelines

- **Where does THAI™ work best?**
 - The Athabasca oil sands provide an excellent example
 - The in situ resources are estimated to be 1.4 TBO

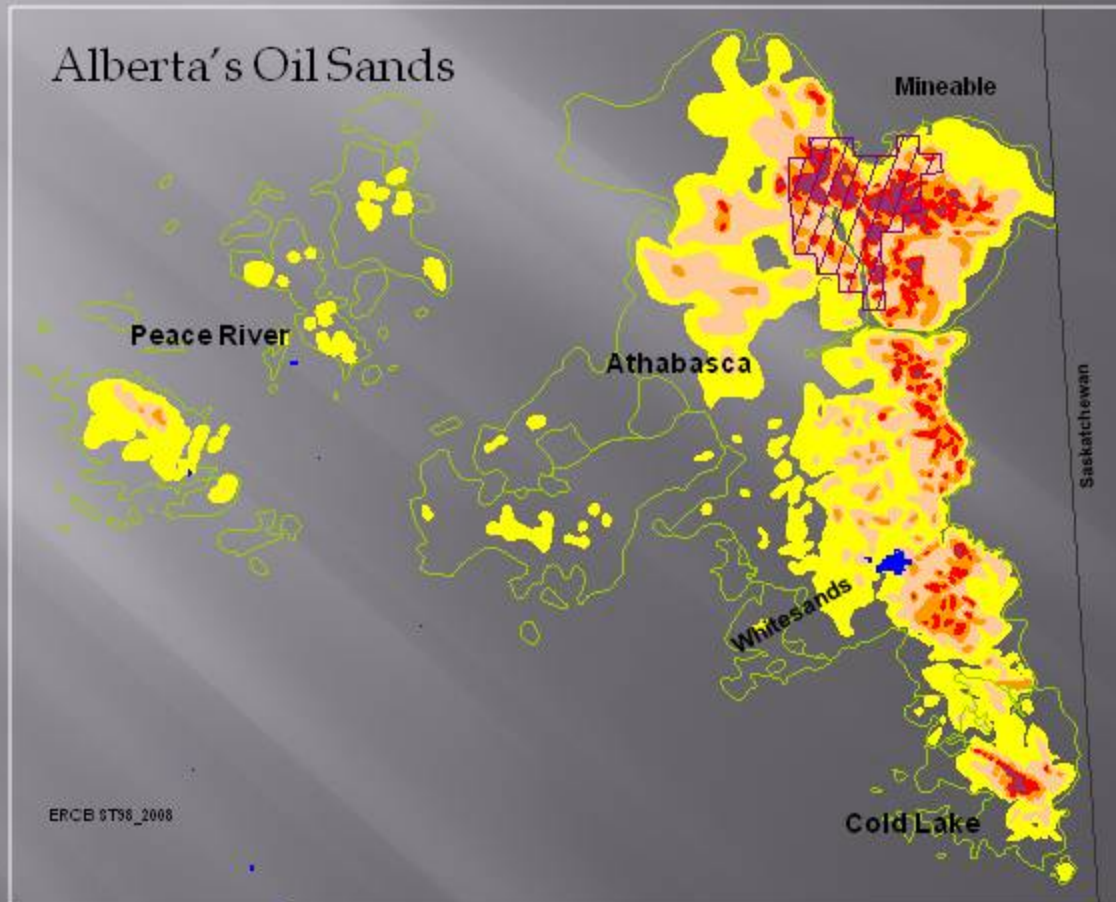
Canadian Oil Sands



THAI™ Resource Estimate

- In Alberta's oil sands commercial in situ projects are focused in very thick pay
- Projects with thinner or discontinuous pay are not advancing. Have the popular recovery methods reached a crossroads?
- This is where THAI™ can contribute significantly

THAITM Resource Estimate



In Situ Projects are currently exploiting very thick pay

Oil Sands Reservoirs



Massive Sand



**Sand with
thin shale**

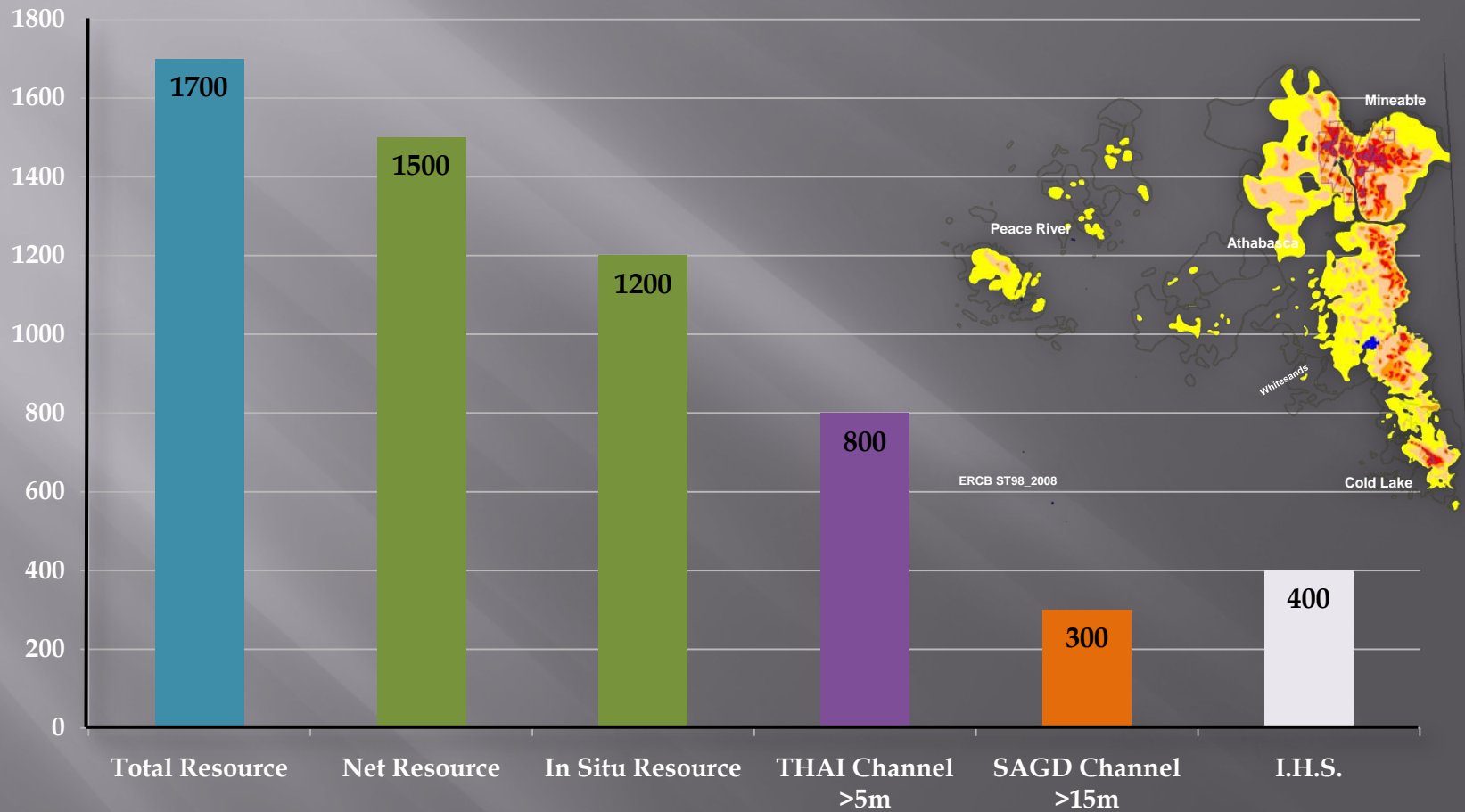


**Sand with
thick shale**



**Sand with
clasts**

THAI™ Resource Estimate



THAI™ Technology

- Technology is the key to unlocking the world's enormous resources of heavy oil and bitumen
- The THAI™ process is a step change in thermal in situ recovery methods for you to consider

THAI™ Technology

- Thank you

