



**EARTH ENERGY RESOURCES INC.**  
**Western U.S. Oil Sands Conference**

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## ISSUES FACING OIL SAND PRODUCTION

- ❑ Issues Facing Athabasca Producers
- ❑ Likely Issues Facing Uinta Basin Producers
- ✓ Technology Advancements Will Provide The Keys To Unlock The Oil Sands in the USA





## PRODUCTION ISSUES FACING ATHABASCA MINING OPERATIONS

- Water Usage and Supply
- Tailings Ponds
- Emulsion Treating
- Inability to Perform Concurrent Reclamation
- Use of Natural Gas as Process Heating Fuel
- Chronic Shortages of Skilled Labour, Constr. Equipment and Municipal Infrastructure
- Product Transportation Infrastructure





## PRODUCTION ISSUES FACING ATHABASCA MINING OPERATIONS

- Water Usage and Supply
  - 2 – 4.5 bbls of water / bbl of produced bitumen.
  - 300,000 bbl/day facility will use 48,000 m<sup>3</sup>/day which is equal to 5% of the 100 year low flow of the Athabasca River.
  - Water usage becoming a key regulatory issue in existing mine expansions and proposed new mines.





## PRODUCTION ISSUES FACING ATHABASCA MINING OPERATIONS

- Tailings Ponds
  - The Clark process requires approximately 5 sq. miles of tailings ponds / 100,000 bbl/day of produced bitumen
  - Jointly necessitated by:
    - Nature of the ore - higher fines content → emulsions
    - Process design - hydro-transport of produced sands
  - Environmental issues include:
    - Evaporative water losses
    - Groundwater contamination due to concentration of heavy metals and acids
    - Floating hydro-carbons affecting waterfowl and wildlife





## PRODUCTION ISSUES FACING ATHABASCA MINING OPERATIONS

- Emulsion Treating
  - Athabasca ores have a relatively high fines content in the range of 12% - 17%.
  - The Clark process shears clay fines in the ore promoting the formation of emulsions that are hard to break.
  - Sheared clay fines, typically having an entrained bitumen content of 6% - 8%, are released to tailings ponds.
  - Breaking emulsions to facilitate bitumen/chemical separation requires addition of environmentally unfriendly chemicals.
  - While 99+% of these chemicals are recovered in the bitumen polishing process, small amounts are released to tailings ponds which concentrate over time.





## PRODUCTION ISSUES FACING ATHABASCA MINING OPERATIONS

- Inability to Perform Concurrent Reclamation
  - Tailings ponds must be constructed prior to the commencement of production.
  - Tailings are hydro-transported to ponds which may not occupy areas from which oil sand ore has already been mined → concurrent reclamation cannot be accomplished.
  - Large mine pits cannot economically or practically be re-contoured back to their original landforms, and may potentially become lakes, as much of the McMurray (producing) formation is underlain by Devonian limestone.





## PRODUCTION ISSUES FACING ATHABASCA MINING OPERATIONS

- Use of Natural Gas as Process Heating Fuel
  - The Clark process uses large quantities of water, heated by natural gas fired boilers.
  - NEB estimates it takes 500,000 BTU of natural gas for every bbl of bitumen (mining and extraction).
  - Combustion gases ( $\text{CO}_2$ ,  $\text{CO}$ ,  $\text{NO}_2$ ) are released to the atmosphere → significant greenhouse gas emissions.
  - Nuclear energy has been proposed and is now being seriously considered as an alternative power supply.





## PRODUCTION ISSUES FACING ATHABASCA MINING OPERATIONS

- Chronic Shortages of Skilled Labour, Constr. Equipment and Municipal Infrastructure
  - Construction delays and huge cost overruns
  - Super-inflation in housing, use of man-camps
  - Municipal and provincial infrastructure stretched to the limit:
    - Roads
    - Bridges
    - Healthcare
    - Education
    - Recreation
  - Alcoholism and substance abuse are major problems; average age 31 yrs, average income \$91,000/yr.





## PRODUCTION ISSUES FACING ATHABASCA MINING OPERATIONS

- Transportation Infrastructure
  - Pipeline and road/rail has had to and will have to expand.
  - Access to upgraders and follow-on refining facilities.
  - Transportation of 10° to 12° API bitumen requires diluent, also in short supply. BP just announced an Indiana based upgrader to be constructed by 2011 to be fed from Athabasca bitumen.



# PRODUCTION ISSUES LIKELY TO FACE UINTA BASIN OPERATIONS





## PRODUCTION ISSUES LIKELY TO FACE UINTA BASIN OPERATIONS

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- Shortages of Skilled Labour, Construction Equipment and Municipal Infrastructure
- Product Transportation Infrastructure





## PRODUCTION ISSUES LIKELY TO FACE UINTA BASIN OPERATIONS

- These are the same issues faced by Athabasca producers and there are few reasons to suspect they will differ.
- What will be different is:
  - The relative importance of each issue.
  - Athabasca levels of production will never be attained.
- Why? Lack of water and a resource base which is 1/100<sup>th</sup> the size of Athabasca. Individual Uintah basin deposits also vary significantly in their geological nature.





## PRODUCTION ISSUES LIKELY TO FACE UINTA BASIN OPERATIONS

- Lack of water will significantly inhibit traditional processes:
  - The cost of water and the lack of availability will either prohibit or drive to an uneconomic level, the costs of traditional processes (Clark, SAGD, CSS).
- The resource base containing an estimated total of 37 billion bbls may contain mineable resources in the order of 20%. Such a resource base will likely preclude the massive Athabasca-type facilities.
- The geological nature of the Uinta Basin deposits differ quite substantially in that they are fragmented, again making unlikely the scale of Athabasca projects.





## PRODUCTION ISSUES LIKELY TO FACE UINTA BASIN OPERATIONS

This is great news !!!

- It forces a rethinking of the technology to be applied to open this resource base while protecting the ecosystems of the region.





## EARTH ENERGY RESOURCES INC.

- A new technology...

The **Ophus Process**, addresses the challenges of surface production in the Uinta basin.

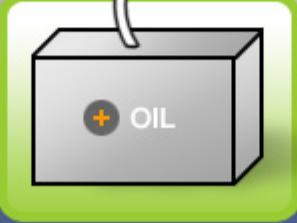
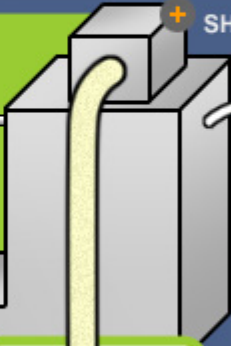
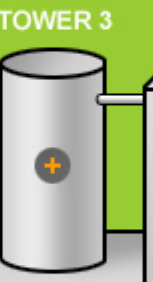
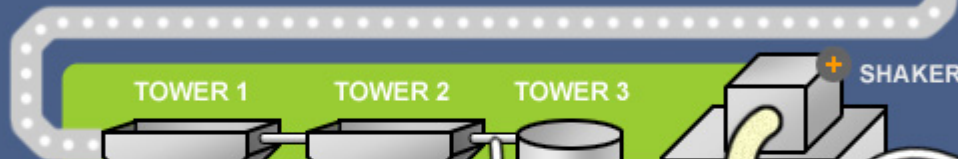




## SUMMARY OF THE OPHUS PROCESS

- Environmentally friendly process aid to accelerate stripping of bitumen from tar sand.
- Short retention time within the unit: < 5 minutes.
- Benefits of the Ophus Process:
  - Process water recycled.
  - Clean, “damp dry” produced sand tailings.
  - No requirement for tailings ponds.
  - Produced bitumen tested and is acceptable as a feedstock to local refineries.







# UTAH PRODUCTION TEST





## PRODUCTION TEST – OCT / NOV 2005

Achieved Goals	Areas of Improvement
<ul style="list-style-type: none"><li>• Clean sand tailings</li></ul>	<ul style="list-style-type: none"><li>• Project execution</li></ul>
<ul style="list-style-type: none"><li>• Water recycled</li></ul>	<ul style="list-style-type: none"><li>• Mining operations</li></ul>
<ul style="list-style-type: none"><li>• Bitumen tested and accepted</li></ul>	<ul style="list-style-type: none"><li>• Ore conditioning equipment</li></ul>





## EARTH ENERGY RESOURCES ... TECHNOLOGY THAT WORKS

- ✓ Water Usage and Supply Constraints
  - The Ophus process uses approximately 30% of the water that the Clark process consumes.
  - The majority of the water “lost from the process” is simply released back the environment entrained in the produced sand stream in the form of damp sand.
  - The forecasted water consumption rates of Earth Energy’s initial bitumen production of 1,000 bbls/day can easily be supported from a deep water well.





## EARTH ENERGY RESOURCES ... TECHNOLOGY THAT WORKS

- ✓ Tailings Ponds – Eliminated
  - 70% to 80% of the water within the production system is recycled, with the balance returned to the environment entrained in the damp sand and minor losses as steam to the atmosphere.
  - The Utah Division of Water Quality tested our produced sand from the fall 2005 production test and found it acceptable to return to the pit from which it was mined.





## EARTH ENERGY RESOURCES ... TECHNOLOGY THAT WORKS

- ✓ Emulsion Treating – Eliminated
  - Utah oil sand ores tend to average only 7% to 10% clay fines → beneficial to almost any process
  - Earth Energy’s patented and environmentally friendly process:
    - Promotes bitumen separation very quickly.
    - Reduces the amount of mechanical energy required to achieve separation.
    - Significantly reduces shearing of clay fines eliminating unbreakable emulsions formed in Clark process froths.
  - Sand and clay fines are relatively easily separated from the process water and produced bitumen using hydro-cyclones and centrifuges for final polishing.





## EARTH ENERGY RESOURCES ... TECHNOLOGY THAT WORKS

- ✓ Concurrent Reclamation – A Reality
  - The process outputs are bitumen, recycled water and damp reclaimable sand.
  - Earth Energy will be able to conduct concurrent reclamation where ore haul trucks will travel loaded in both directions, allowing the operation to advance through the deposit reclaiming as it goes.
  - As the producing terrain in Utah is more undulating than in the Athabasca region of northern Alberta, it will be easier to re-contour mined areas to near-original landforms as has been achieved at the Simplot phosphate mine operation north of Vernal.





## EARTH ENERGY RESOURCES ... TECHNOLOGY THAT WORKS

### □ Energy Consumption

- Expected to be comparable on a produced barrel basis to Canadian operations in Athabasca, despite negative economies of scale.
- Utah oil sand ores tend to be more consolidated and more oxidized than that of Athabasca, increasing the mechanical effort in mining from “excavating” to “in-situ milling”.





## EARTH ENERGY RESOURCES ... TECHNOLOGY THAT WORKS

- ✓ Shortages of Skilled Labour, Construction Equipment and Municipal Infrastructure
  - There will be no doubt a continued buoyant labour market will exist in the oil and gas sector in Utah.
  - Labour supply and associated social issues with Utah operations will not approach the magnitude of those being encountered in Athabasca due to the much reduced scale of feasible operations in Utah.





## EARTH ENERGY RESOURCES ... TECHNOLOGY THAT WORKS

### ✓ Transportation Infrastructure

- This factor has been identified as a major short-coming for contemplated operations in Utah.
- Earth Energy's producing property is located in an extremely remote area, devoid of all-weather road access, product pipelines and municipal infrastructure.
- Production operations will have to be based on a rotational camp arrangement (similar to Athabasca).
- Other producing areas in Utah (Asphalt Ridge and, to a lesser extent, Sunnyside) are not faced with transportation/infrastructure challenges of the same magnitude.



# Canadian Natural Resources Airstrip

6500' paved runway, 50 miles north of Ft. McMurray, AB



## Transportation bottlenecks threaten oilsands growth



A landing strip in a muddy field allows Canadian Natural Resources to bring workers in from Edmonton. Photo: Tom Fraser, Calgary Herald

LISA SCHMIDT  
CALGARY HERALD  
HORIZON OIL SANDS  
PROJECT

It's a commute of megaproject proportions. Last month, hundreds of workers boarded a 777 jet in Edmonton and Calgary to fly to a work camp north of Fort McMurray.

The flight, up to four a day, brings the labourers to Canadian Natural Resources' Horizon oilsands project and back. At its peak, the \$2.8-billion project will have as many as 6,000 employees on its site, working 12-hour shifts.

Traffic to the freshly paved landing strip, which sits in the middle of muddy field cleared from the boreal forest, could rival that of Fort Mc-

But the proposal never took off, even though the province helped fund a \$12-million feasibility study.

"There's been nothing but an increased need for some type of a comprehensive and effective transportation system," says Gray, the former head of Canadian Hunter. "It's far from dead."

Gray's group, the Athabasca Oil Sands Transportation Corp., is now examining other options to get it built, including a public-private partnership or an entirely private route.

The costs could also change, depending on the model, and whether the project proceeds in stages.

But he acknowledged that time may be running out. If there's no progress by year-end, the idea will likely be



Reference: Calgary Herald, October 24, 2005

## The PR Spring International Airport!





# EARTH ENERGY RESOURCES

## CURRENT WORK PLAN

- Technical and economic proof of concept
  - Shop Demonstration Unit in Grande Prairie, AB
  - Independent federal research laboratory
  - Engineering firms and suppliers
- Land acquisitions
  - State of Utah
  - Private oil companies with combined leases
  - Athabasca opportunities
- Resource estimate for leased lands
- Large mining permit for lands in Utah





QUESTION AND ANSWER PERIOD

THANK YOU