Evaluation of Potential Make-Up Water Sources for a Proposed In-Situ Bitumen Recovery Project
Fort McMurray, AB

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WaterTech 2013 – Banff, AB – April 10, 2013
Presentation Outline

- Description of ET-DSP™ Project

- Environmental, social and economic sustainability assessment methodology (EcoNomics™ framework)

- Review of potential water sources

- Screening level review of environmental and social impacts, economic costs of preferred options

- Next step: EcoNomics™ DELTA
E-T Energy’s oil sand leases

[Map showing the location of E-T Energy’s oil sand leases in Alberta, Canada, with a focus on the Athabasca Oil Sands region.]

[Map highlighting the leaseholdings of E-T Energy around Fort McMurray, with adjacent oil sands regions and major cities such as Calgary and Edmonton.]
ET-DSP™

Power Delivery System (PDS)

Extraction Well (X-Well)

Bitumen & Water

16 metres

Electrode Wells (E-Well)

Electricity & Water

6 metres

Water Injection Ports

Electrodes

Current Flow

Downhole Pump

Depth To Top Of Pay (5 - 250 metres)

Bitumen Pay (30 metres)

ET-DSP™ Depth

526 Billion barrels OBIP
Effective up to 250m in Depth

<table>
<thead>
<tr>
<th>Mineable Depth</th>
<th>&quot;Stranded&quot; Depth</th>
<th>SAGD Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 75m</td>
<td>189 Billion</td>
<td>150m +</td>
</tr>
<tr>
<td>barrels OBIP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>75 - 150m</td>
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Source: TD Newcrest, based on well data contained in the ERCB's Reserves 2007 and Supply/Demand Outlook 2008-2017
Sustainable decisions recognize and value the relationships that exist between multiple risks and opportunities ... over the long term.
Sustainability Assessment Framework

Delivering profitable sustainability EcoNomics™

Our range of services and technologies that profitably embed environmental, social and financial sustainability into project delivery, across the asset lifecycle.
Methodology - Study Process

EcoNomics™ Framing Workshop
Objective, options and parameters defined

Options Development

EcoNomics™ DELTA

Life Cycle Analysis
Cost Benefit Analysis
Risk Assessment
Sensitivity Analysis

Decision Making and Implementation Support
Project Water Requirements

- Make-up water requirements for 10,000 bbl/day
  - 1,592 m$^3$/day (equal to the full scale bitumen production rate)
  - 50 m$^3$/day (domestic and utility use)
  - 1,642 m$^3$/day total (assumes 100% produced water recycle)

- Evaluated as Tier 2 under Water Conservation and Allocation Guideline for Oilfield Injection
  - Allocation > 450 m$^3$/day
  - Project presents low risk and low impact to area’s water resources
E-T’s objective statement
“To obtain a reliable and cost-effective supply of make-up water for the Poplar Creek project that minimizes the need for fresh water, reduces land surface development impacts and lowers CO₂ emissions.”
Potential Water Sources

- Traditional
  - Surface water ‘ many regional pressures
  - Groundwater (saline or fresh)

- Alternatives
  - Produced water
  - Industrial wastewater
  - Municipal wastewater

- Emergence of regional water management initiatives to foster collaboration and improve sustainability
Athabasca River is tantalizingly close, but...

No other adequate, year round potential sources in search radius
Q_{20} Basal Km = 59 \, m^3/d

Other intervals not suitable, generally due to low K (Q_{20} < 10 \, m^3/d)
- Keg River Fm. (also very high TDS)
- Beaverhill Lake Gp.
- Upper to Middle Km
- Wabiskaw Member of Clearwater Fm. (may not be saline)
Fresh Groundwater

- $Q_{20\text{ Quat}} = 31 \text{ to } 154 \text{ m}^3/d$
- Generally, low K till
- Regional trend suggests increase in Quaternary deposits to west - aquifers?
Alternative Water Sources

- Process wastewater
- Groundwater diversions
- Others?

12,000,000 m$^3$/yr
98.8% not used
Alternative Water Sources

- Municipal wastewater
  - Treatment plant approximately 9km from CPF
  - Potential future municipality pipeline going right by site?
Multi-Criteria Decision Analysis (MCDA)

Evaluative criteria – environmental, social, economical, as well as technical feasibility

- energy consumption
- CO₂ and particulate emissions
- risk to water resources
- freshwater usage
- waste volume/mass
- relative ease and timeline of reclamation
- initiatives to mitigate environmental impacts
- land disturbance
- permitting difficulties
- stakeholder concerns
- protection of community and workers
- nuisance impacts (such as odours, light, noise, visual)
- constructability and infrastructure requirements
- technology reliability
- direct economic benefit to community
- future liability
Options rankings:
1. Parsons Creek saline - p/l (9b)
2. On-site saline gw (1)
3. Athabasca R. – p/l (3)
4. Parsons Creek fresh – p/l (9a)
5. Suncor Basal DP – p/l (7)
### Screening Level Costs

<table>
<thead>
<tr>
<th>Option</th>
<th>9</th>
<th>1</th>
<th>7</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Source</strong></td>
<td>Quarry water Parsons Creek, pipeline</td>
<td>Onsite saline groundwater</td>
<td>Basal depressurization water from Suncor, pipeline</td>
<td>Quarry water Parsons Creek, truck</td>
</tr>
<tr>
<td><strong>Total Direct &amp; Indirect Capital Cost</strong></td>
<td>$2,662,035</td>
<td>$4,461,700</td>
<td>$13,591,200</td>
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<tr>
<td><strong>Engineering &amp; Professional Fees</strong></td>
<td>$532,400</td>
<td>$892,300</td>
<td>$2,038,700</td>
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<tr>
<td><strong>Project Contingency</strong></td>
<td>$798,600</td>
<td>$1,338,500</td>
<td>$3,907,500</td>
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<tr>
<td><strong>Total Installed Cost</strong></td>
<td>$3,993,035</td>
<td>$6,692,500</td>
<td>$19,537,400</td>
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<tr>
<td><strong>Annual O&amp;M Cost</strong></td>
<td>$198,750</td>
<td>$373,730</td>
<td>$834,880</td>
<td>$3,504,000</td>
</tr>
<tr>
<td><strong>20 Year Project Life O&amp;M Cost</strong></td>
<td>$2,476,864</td>
<td>$4,657,502</td>
<td>$10,404,450</td>
<td>$43,667,585</td>
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<tr>
<td><strong>Total Installed Cost + 20 Year O&amp;M Cost on a Net Present Value Basis</strong></td>
<td>$6,469,899</td>
<td>$11,350,002</td>
<td>$29,941,850</td>
<td>$43,667,585</td>
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Next Steps

EcoNomics™ Framing Workshop
Objective, options and parameters defined

Options Development

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Life Cycle Analysis
Cost Benefit Analysis
Risk Assessment
Sensitivity Analysis

Decision Making and Implementation Support

Stakeholder Input
Customer Input

Environmental, Social, and Health Impact

Engineering + Cost Estimating