Innovating Our Way to Closure: Emerging and Digital Technologies for Efficient Reclamation of Legacy Oil and Gas Sites

Presenters
InnoTech Alberta - Simone Levy
Menome Technologies Inc. – Mike Morley
Key Issues

• ~165,000 wellsites pending reclamation
• Licensee liability rating challenges, increasing orphans
• Aging infrastructure
• 1.8M ha O&G footprint
  • Habitat fragmentation
  • Development constraints
• 925,000 tonnes of soil to landfill/year
• $58.65B liability estimate per AER
Points to Ponder

• What does our industry look like in 2030 and beyond?
  • Landscape
  • Oil and gas sector/WCSB
  • Health of service providers

• Where is Canada compared with the rest of the world in terms of technology adoption?

• Environmental and engineering sectors are moving rapidly to rely on digital and emerging technologies – e.g., NRCan, ‘Digital Oil and Gas’ initiatives
**Identifying and validating potential opportunities**

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<th>Technology or Process Improvement</th>
<th>Execution Impact</th>
<th>Industry Impact</th>
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| **Sensors and Remote Sensing**    | • Improve delineation and monitoring capabilities  
• Reduce site visits            | • Cost savings  
• Process streamlining  
• More sites addressed per $ | |
| **Digital Platforms**             | • More effective decision making  
• Support service providers  
• Reduce data silos  
• Focus on technical vs. repetitive tasks  
• Identify re-use opportunities to maximize existing investment – sites and equipment | • Greater utilization of service providers -> lower rates  
• Enhanced collaboration  
• Creating opportunities through re-purposing | |
| **Leveraging AI/ML in Process**   | • Optimizing process/efficiency  
• Refine equipment capabilities  
• Manage big data | • Process streamlining  
• Increased effectiveness | |
| **Optimizing soil and water treatment technologies** | • Streamline selection and virtually establish success  
• Reduce volumes of soil disposed and associated GHG emissions  
• Shorten timelines and improve certainty of reaching closure | • Increased sustainability  
• Cost reduction  
• Improved social license | |
CRIN Land Theme – Proposed Vision and Goals

**Vision:** To leverage a network of forward-thinking individuals to accelerate land reclamation through technology and process innovation.

**Goals:**

- Connect innovators and industry to find synergy and grow Alberta businesses.
- Collectively identify high priority challenges and address through strategic innovation, research and demonstration.
- Encourage ‘out of the box’ thinking to drive innovation, stretch $, return land to productive use, or find alternative uses for disturbance.
- Make innovation and resulting tools more accessible to Alberta businesses.
Three Challenges

- Skyrocketing US Production
- Social License
- Job Losses
- Flight of Capital and Investment
- Orphan/Inactive Wells

Environmental Concerns and Government Policies
People are doing great work in technology:

I'll be honest, the way to stay on this track, is to not let oil prices get back to $80-$100 a barrel.

As soon as that happens, everybody's eye goes off the prize and we're back to the same old, same old.
WHY INNOVATE?

Technology Amplifies our Abilities

- Ability to do more with less
- New ways to solve problems
- New capabilities that create new opportunities

Innovation builds resiliency and the ability to adapt to whatever comes at us

What we’re doing is building tools to amplify a human ability. Apple is building a ‘bicycle for the mind’.

~ Steve Jobs
When life presents us with a problem, we start by exploring solutions based on solutions to similar problems in the past. This works as long as the conditions for the solution are still valid.

This does not work when the environment is changing rapidly as the rules of the game have changed.

Innovation takes place by combining ideas from known experience, with those outside the normal plane of experience.

Discovery takes place when the blinders of habit are removed.

Solutions often come from adjacent contexts.
1987

Road bike with big tires

Trails:
Fire road
XC/Hiking

1986 Rockhopper
Hard Tail
CrMo frame
29-30 lbs
Bottom mount
U Brake
Challenges generate pain

Incremental Innovation addresses immediate pain

Disruptive innovation occurs when new capabilities open new unforeseen opportunities

Having an innovation mindset is the key key to surviving unforeseen challenges
2019

Improvements to suspension (lock outs, variable air chambers), frame geometry and carbon fiber wheels

Trails: we don’t need trails!

2019 Santa Cruz Nomad
All carbon including rims

6” Front Fork
6” Rear
Carbon Fiber

29 lbs
52 – Fastest times on all downhills this year....Augmented Abilities through technology.
In 2001 you could fire a cannon through the village.

Lifts + Tail Building + Mountain Bikes

= An entire new industry created by innovation...

Whistler now has more visitors in the summer than in the winter.

Whistler receives approximately 3 million overnight and non-overnight visitors each year (approximately 45 per cent in winter and 55 per cent in summer).
“There’s been the introduction of a new generation of data science. We’ve seen a long list of technologies—for instance, robots, machine learning, artificial intelligence, new sensors—that are assisting the transition to greater digitization in the oil and gas business. The result has been a step change with increased computing power, connectivity and logistics.

These applications are driving greater efficiencies that reduce costs and environmental impacts.”

Innovation Trends in Canadian Oil and Gas: Peter Tertzakian

Economist, energy consultant and author discusses disruptive innovations transforming oil and gas for the future
MINE OF THE FUTURE – IS ALREADY HERE - FULLY OPERATIONAL FULLY AUTONOMOUS DRILLING, TRUCKS, TRAINS -

When surviving competitively afloat the mining industry’s ocean of high and low tides seemed impossible, Rio Tinto leveraged Big Data and Machine Learning to revolutionize the mining industry over the past decade, through its state-of-the-art autonomous operations.

“...we miners have little choice but to adopt the mindset of Silicon Valley... we will seek to take a new approach to capitalise on the megatrends... of the future...”

– Bold Baatar, Chief Executive – Energy & Minerals, Rio Tinto

73 Autonomous hauling iron ore 24 hours a day by 2012

DATA OPERATIONS

https://www.technologyreview.com/s/603170/mining-24-hours-a-day-with-robots/
BENEFITS OF TECHNOLOGY

EFFICIENCY

"These autonomous trucks, have reduced fuel use by 13 percent and hence improved environmental performance by 13 percent."

REDUCED COSTS

Rio Tinto’s automated blast hole drill system enables a single operator to use a single console at a remote location from the machinery and operate multiple drills.

INCREASED SAFETY

It’s much safer for the operators, and it is more precise using technology.

"Who would have thought just 10 years ago that a mining company would use big data to analyse variation of plant and mine performance from a global perspective….”

Rio Tinto preparing for the Mine of the Future with automation

With the company’s long-haul autonomous rail system set to go live later this year, Rio Tinto’s former CEO offered a glimpse into how it has been using data and automation to prepare for the Mine of the Future.

By Asha Barbaschow | February 26, 2018 -- 04:24 GMT (20:24 PST) | Topic: Innovation
The expertise is supported by a non-profit organizations and academic departments.

The Northern Centre for Advanced Technology (NORCAT) operates a working mine that allows fledgling inventors to try out new technology in an operating environment.

In the early 1970s, Inco employed more than 20,000 people in its Sudbury mines. By 2006 that number had shrunk to about 4,500.

Today the number of workers in Sudbury has fallen further, to about 4,000.

Despite the vastly reduced work force, Vale's Sudbury mines produce more nickel today than they did in the 1970s.

Automation that has boosted productivity....
ALBERTA OF THE FUTURE
- INNOVATION IS THE FOUNDATION FOR DIVERSITY, AGILITY, AND SUCCESS -
Augment People’s Abilities

Let Machines Do The Boring, dangerous Work

Recognizing objects from documents, pictures, videos, audio files
• Wildlife Detection
• Pipeline Integrity Analysis
• Automatically classify photos
• Soil Classification
• Failure Prediction
• Safety Detection

REDUCED COSTS
INCREASED SAFETY
EFFICIENCY

Object detection (Age, Gender)
Threshold 0.5
Train Name Clear Dataset
Data is the foundation of ALL INSIGHT

Data Insight

Deploy

AI Deep Learning

Model
Machine Learning, Algorithms

Aggregate
Analytics, Metrics, Training

Transform & Process
Clean Data, Detect Anomalies

Move & Store
Structured & Unstructured Data

Collect Data
Sensors, External Data, User Generated Data

What is the Goal?

WHAT YOU COULD KNOW....
IF YOU HAD THE RIGHT DATA...
INCREME NTAL IS NOT ENOUGH

Think BIG

Think Disruptive

THINK BEYOND

2004-2014 Incremental Innovation in Environmental Work

© marktoonist.com
Alan Kay – Creator of the Mobile

The best way to predict the future is to invent it.
Work to Date – InnoTech Alberta, CRIN and Partners

• Outreach program – scoping
  • Collaboration
  • Streamlining
  • Risk management

• 2018 Workshop
  • Managing soil
  • Leveraging data
  • Supporting collaboration
  • Environmental and oilfield service providers

• 2019 Workshop
  • Solution pathways
  • Roadmap and/or Efficiency Hub
Supporting Innovation...Your call to action

• Talk to peers – share learnings
• Explore the cutting edge in adjacent industries (and other parts of O&G sector)
• Collaborate with entrepreneurs and technology developers
• Access resources (i.e., CRIN) to join technology development working groups and events – November 2019 workshop
• Help de-risk and enhance adoption of technologies by supporting pilot work
• Share successes to grow and refine our industry, while building worker capacity
Follow CRIN and join online discussions

- **Follow CRIN on the Public LinkedIn Page** to get the latest updates on current CRIN events, news and activities and updates for network members.

- **Join our Member-only group pages** for technology-focus areas with exclusive content and discussions, accessible only to CRIN members:
  - Canadian Fuels Standard – Reducing the Carbon Intensity of the Barrel
  - Clean Resource Innovation Network (CRIN) Members
  - Digital Oil and Gas Technology
  - Low to Zero Carbon Hydrocarbon Production to End Use
  - Methane Monitoring, Quantification and Abatement
  - Novel Hydrocarbon Extraction
  - Novel Land and Wellsite Reclamation
  - Water Technology Development

*Note: You must be logged into your LinkedIn account to view groups and must request to join these groups.*