ENVIRONMENTAL INNOVATION IN THE OIL SANDS
ECONOMIC CONCEPTS AND CASE STUDIES

1. OPPOSING ECONOMY AND ENVIRONMENT: A FALSE DEBATE
The economy is neither good nor bad for the environment; it is an integral part of it. These two realities are pervasive and interrelated, not adversarial.
Source: AppEco 2019

2. INNOVATION AND ENVIRONMENTAL MANAGEMENT IN THE OIL SANDS
• Significant activities, because they are directly related to the scale of production
• An integral part of a company’s value chains, both for performance and cost reduction

3. COSIA: AN OPEN SOURCE COLLABORATIVE APPROACH
• 981 distinct shared technologies and innovations
• Total development cost: $1.4B
• 308 active projects in 2017 only—total project value: $545M

4. GROWTH IN OIL SANDS OVER A DECADE

5. WEEKLY PAY
Average weekly earnings: approximately $2,700, almost 3 times the Quebec average and 2.4 times the Alberta average.

6. A SIGNIFICANT IMPROVEMENT IN ENVIRONMENTAL PERFORMANCE
• From 2010 to 2016, GHG emissions per barrel produced: -17%.
• In Canada, the environmental performance of facilities varies widely, with the highest performers generating fewer GHGs per barrel than the U.S. average.
• By 2030, GHG emission intensity could fall by another 16-23%.

7. SIGNIFICANT ECONOMIC BENEFITS FOR QUEBEC INCLUDE:
• $1.2B in contracts to 371 suppliers
• 16,200 jobs, including 8,600 direct jobs
• $288 million in taxes, including $215 million for the Government of Quebec
Source: AppEco
1. **FIVE CASES OF ENVIRONMENTAL INNOVATION**

1: LiDea—Caribou Habitat Restoration  
2: GHGSat—Measuring Greenhouse Gases  
3: Virtual Sensors—Once-Through Steam Generators, or OTSGs  
4: Tailings Management by CO₂ Addition and Capture  
5: OTSG Natural Gas Turbine

2. **ENVIRONMENTAL INNOVATION CASE STUDIES**

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<th>Environmental Sector</th>
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<th>Description</th>
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</table>
| Greenhouse gases     | ✔ | ✔ | ✔ | ✔ | ✔ | (Case 1) Conversion of source sites to CO₂ sinks  
|                      |   |   |   |   |   | (Case 2) Increased accuracy and frequency of measurements  
|                      |   |   |   |   |   | (Case 3) More accurate and effective OTSG operation  
|                      |   |   |   |   |   | (Case 4) Capture of CO₂ and injection into tailings  
|                      |   |   |   |   |   | (Case 5) Decreased consumption of Alberta produced electricity |
| Territory            | ✔ |   |   |   |   | (Case 1) Restoration of forests and caribou habitat |
| Tailings management  |   |   |   |   |   | (Case 4) Fine particle capture and reduction of the tailing pond area required |
| Water                |   | ✔ | ✔ |   |   | (Case 3) Vapour quality improvement, less water required for production  
|                      |   |   |   |   |   | (Case 4) Increases clarity and decreases water requirements for ponds |
| Monitoring           |   | ✔ |   |   |   | (Case 1) Data on growth of vegetation and wildlife  
|                      |   |   |   |   |   | (Case 2) Satellite measurement of GHG emissions from tailing ponds and mines |

3. **ENVIRONMENTAL IMPACT**

Most of the projects addressed several environmental areas, all of which focused on GHG reduction.

4. **ECONOMIC IMPACT**

- Increased revenues: greater production efficiency  
- Decrease in production costs: $45M minimum total savings  
- Creating or sustaining jobs: 20 to 25 net

5. **APPLICATION TO OTHER SECTORS**

- Caribou habitat restoration: in any boreal forest context  
- Measuring GHG emissions: various business sectors, e.g., mines, landfills and agriculture  
- Virtual Sensors: any sector generating steam by using OTSGs  
- CO₂ capture in non-segregated tailings: any mining industry where tailings are stored in oil sands-like ponds

6. **APPLICABILITY TO THE QUEBEC ECONOMY**

Many of these innovations could be adopted in Quebec, in sectors totalling 1.1 million jobs:

- Manufacturing  
- Construction  
- Transportation  
- Professional and technical services  
- Waste management  
- Etc.