Alberta Innovates Technology Futures

The Relationship Between Technology and Policy,

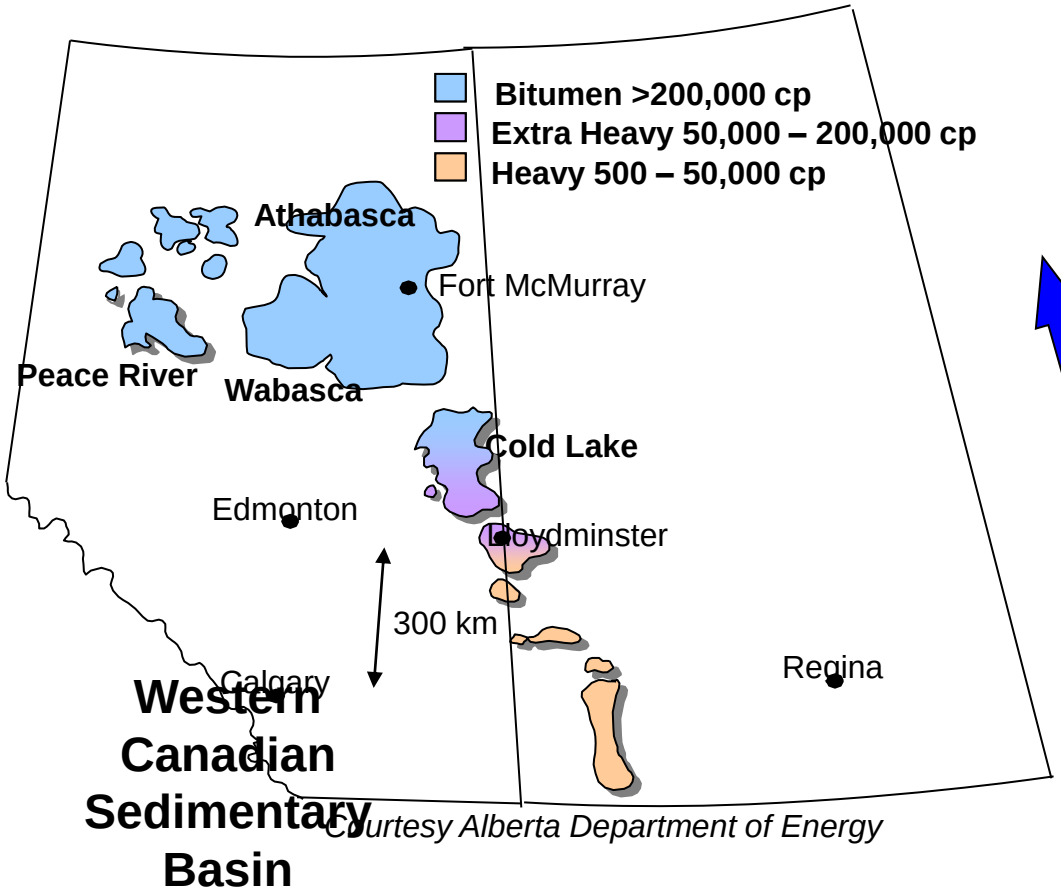
some Examples from the Oil Sands of Alberta

Ross Chow

Alberta

Freedom To Create. Spirit To Achieve.

The oil sands of Alberta



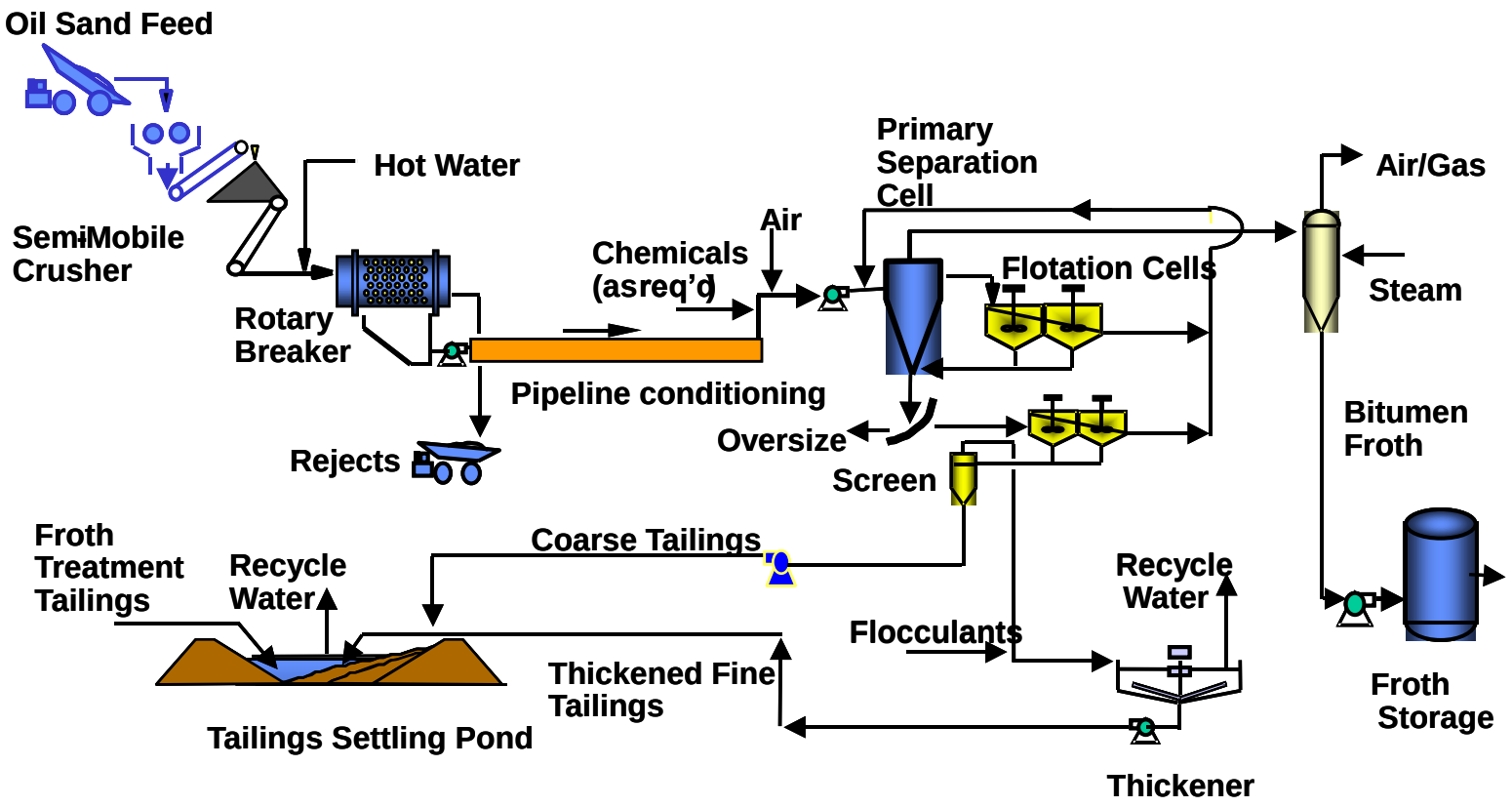
Courtesy Alberta Department of Energy

Increasing viscosity
Decreasing API
Decreasing depth
Decreasing pressure
Decreasing GOR

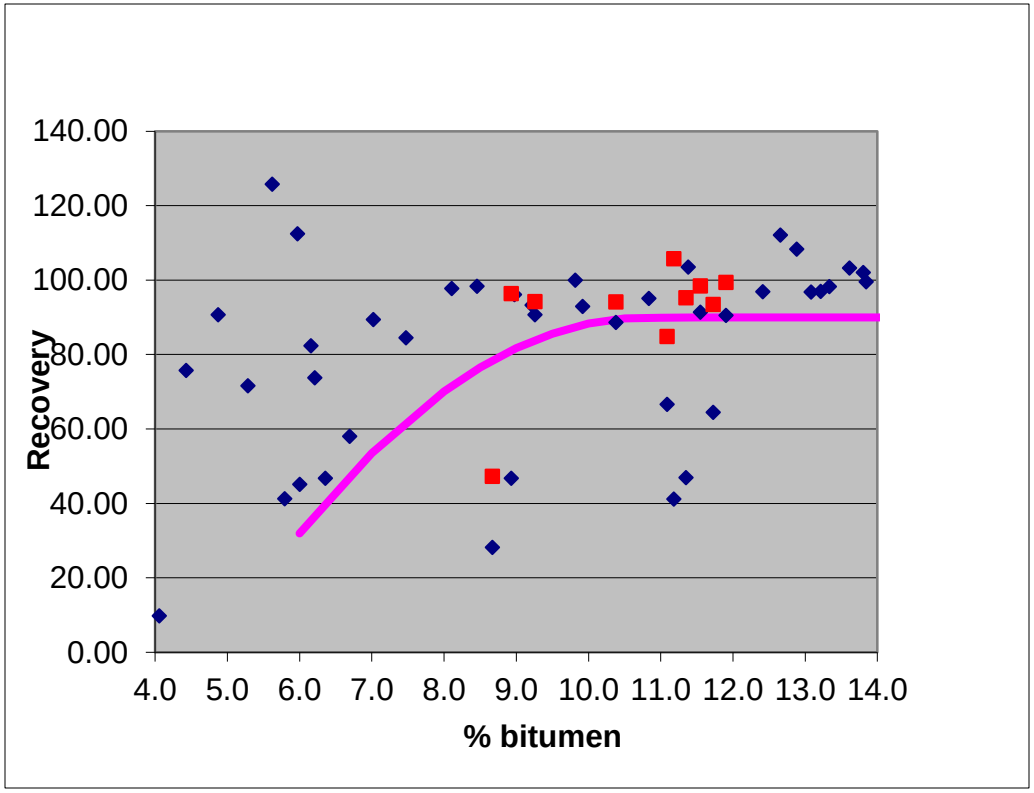
Surface mined extraction process

- Oil sand is mined and bitumen is separated from the sand
- Large operations (typical plant ~ 200,000 bbls/day)
- Immense material handling (in extraction, 12,000 T oil sand/day, 24,000 T water)
- Approximately 20% resource available by mining

Schematic of Bitumen Extraction Process



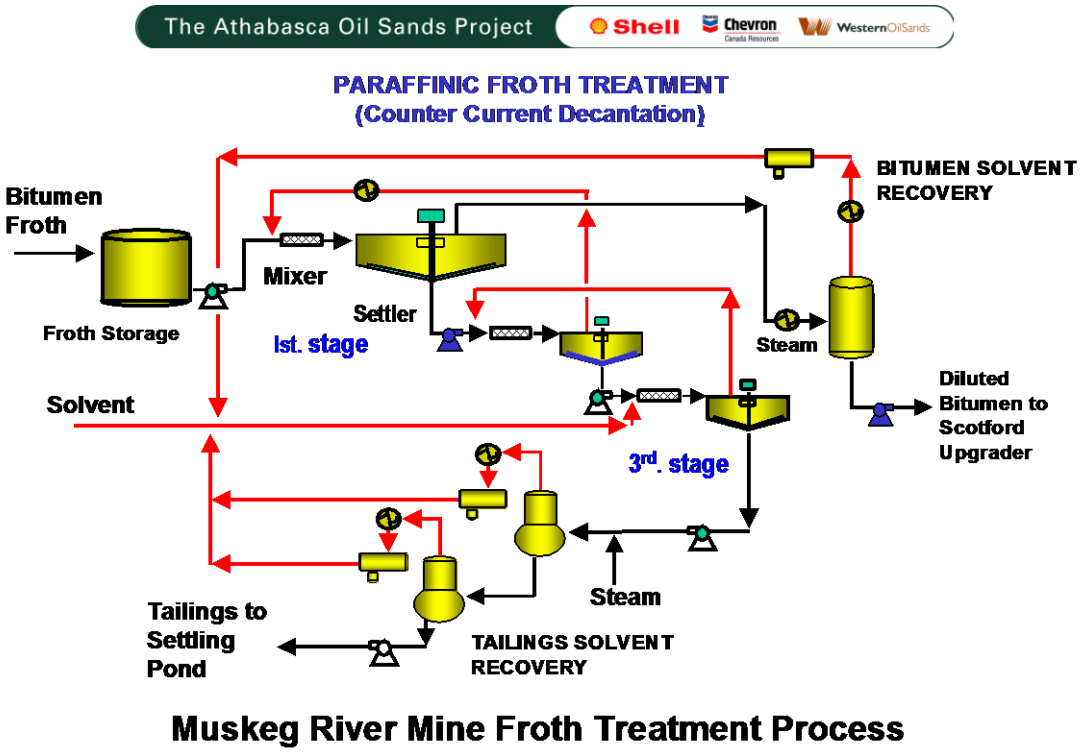
Policy : Minimum recovery requirement



- Regulation in recovery led to the development of chemical technologies to increase recovery

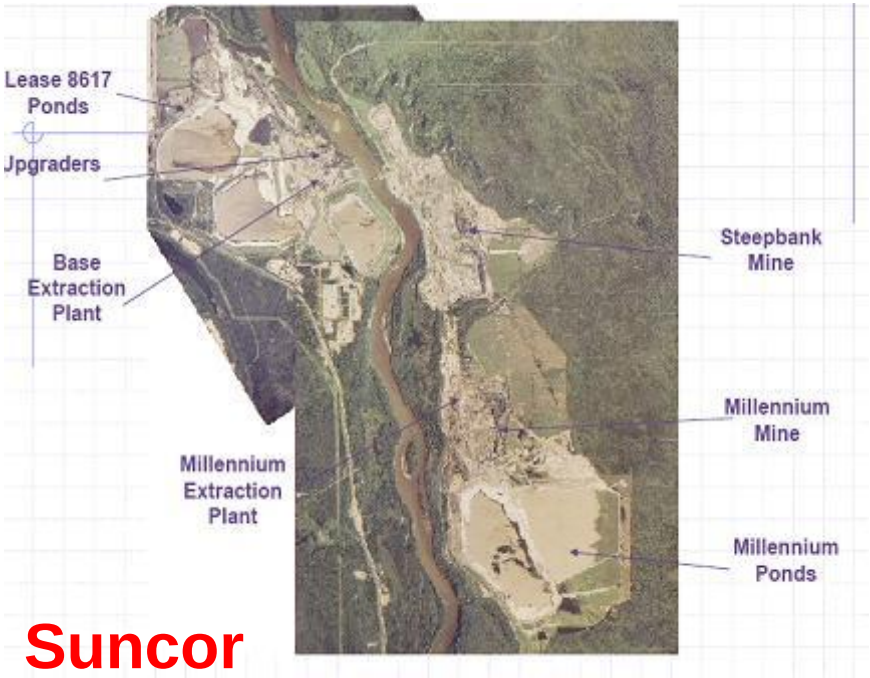
Policy: supporting new technology

- Technology: paraffinic froth treatment proccess
- Use of paraffinic solvent to precipitate asphaltenes
- Enhances settling of water and solids
- Demonstrated with aid from Federal and Provincial gov't



Muskeg River Mine Froth Treatment Process

Oil Sands Mining and Tailings Ponds



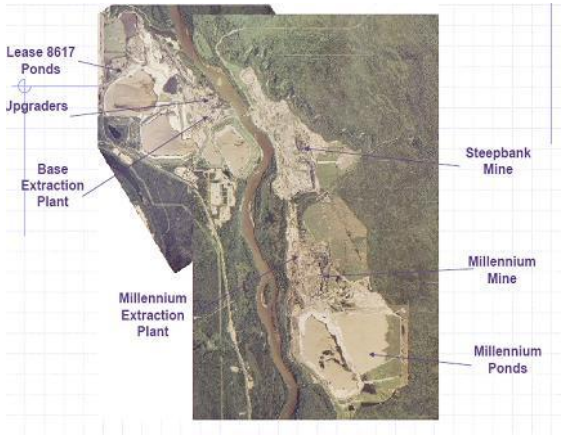
Suncor

Syncrude

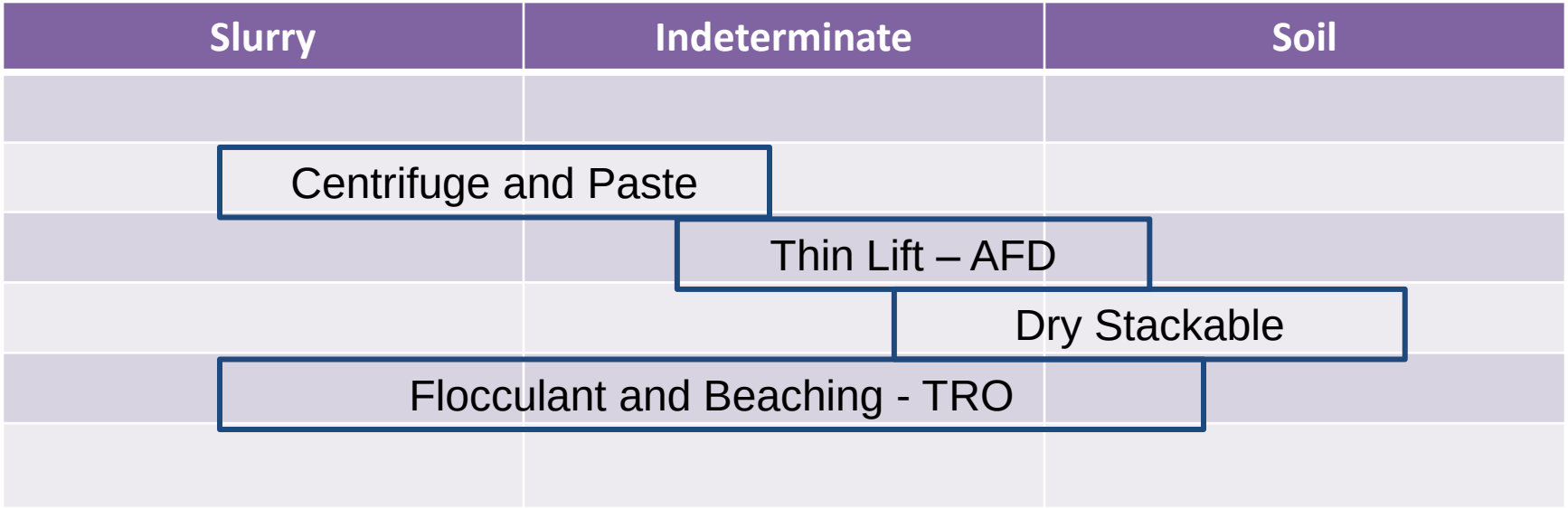
Unexpected consequence: emphasis on recovery was one of the key factors in the creation of tailings ponds

Policy: Directive 74

- Directive 74 – no additional Mature Fine Tailings created, fines (dry) in Designated Disposal Area (DDA), Geotechnical strength of 5 KPa in one year, proposed timelines will not be met
- Companies will be testing technologies in the field because of proposed timeframe restrictions
- Need to convert ‘slurry to soil’ in order to remediate tailings streams



Current tailings technologies



Implementation of Directive 74 will result in:

- Acceleration of deployment of tailings remediation methodology
- Formation of the Oil Sands Tailings Consortium- an unprecedented cooperative effort

Policy: formation of AOSTRA

- 1974 Government of Alberta made a strategic decision to form the Alberta Oil Sands Technology and Research Authority with the objectives of:
  - At least one in situ recovery process for each major oil sand reservoir type
  - More effective, efficient, and environmentally acceptable upgrading technology
  - Resolution of major technical problems of current surface mining technology
  - Evolutionary increases in recovery from in situ processes
  - Alternative surface extraction technology
  - Conversion of oil sands and heavy oils into higher valued petroleum and mineral products
- $100 million for first five years

AOSTRA

- AOSTRA addressed their objectives through several activities:
  - Supporting the testing of commercial processes and technologies
  - Establishing University Programs/Chairs
  - Owning and licencing IP
  - Establishing an Investors Grant Assistance Program
  - Establishing a publishing company

- AOSTRA evolved into the Alberta Energy Research Institute in 2000, in 2010 the Alberta Innovates-Energy and Environment Solutions (AIEES) was established

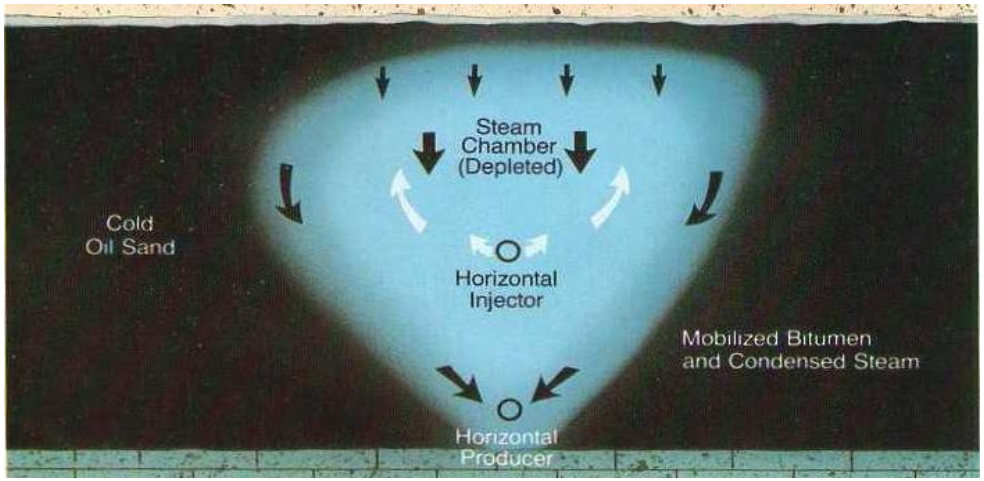
AOSTRA - highlights

- University Chairs established in: Numerical Modelling for Oil Sands, Geotechnical Properties of Oil Sands, Combustion, SAGD
- Research programs at provincial research organizations (ARC)
- 23 pilots supported (12 in Athabasca) including:
  - Combustion pilot at Wolf Lake
  - 7 spot steam injection pilot at Peace River
  - Steam drive pilot in Grosmont – carbonates
  - Underground test facility (UTF)

Many of the AOSTRA staff became leaders in the Alberta Oil Sands industry

AOSTRA and SAGD

- Support from AOSTRA through fundamental research, large scale experiments, modelling and piloting accelerated the development of SAGD
- UTF was instrumental in proving the technology in a viable reservoir process
- Successful pilot projects led to the current state of SAGD in Athabasca

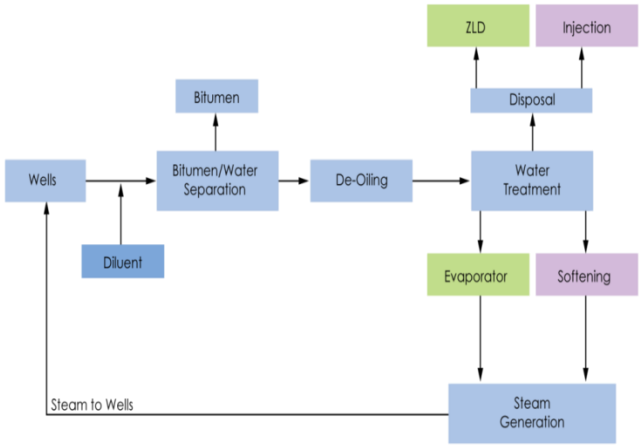


Policy: Requirement to recycle produced water

- By regulation 75% of produced water in insitu operations must be recycled
- Led to the development of many different water treatment systems
- Currently recycling ~90% of produced water
- May be applied to more remote reservoirs where fresh water is not available

Water recycle treatment train

- Although demonstrated at commercial scale, optimization is ongoing
- Steps of deoiling, softening, ion exchange and evaporation
- New technologies under consideration include: membranes (both film and ceramic), electro-capacitive separation, falling film evaporation and crystallization.



Goettsch, 2006

Does policy drive technology?

- Policy can take many forms:
  - Strategic intent to support development- AOSTRA
  - Conditions on development: recovery of bitumen from surface mining, SAGD water recycle
  - Regulatory: in response to public concern – formation of OTSC

- Developments in the oil sands of Alberta were greatly accelerated with implementation of appropriate policy

Alberta Innovates Technology Futures

Thank you

Alberta

Freedom To Create. Spirit To Achieve.